Biological Services Program

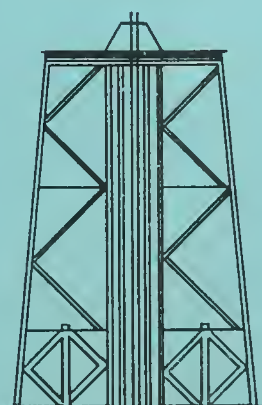
FWS/OBS–77/16.2
March 1978

Environmental Planning for Offshore Oil and Gas

Volume V:

Regional Status Reports

Part 2: Mid and South Atlantic



Fish and Wildlife Service

U.S. Department of the Interior

The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems. The mission of the program is as follows:

- To strengthen the Fish and Wildlife Service in its role as a primary source of information on national fish and wildlife resources, particularly in respect to environmental impact assessment.

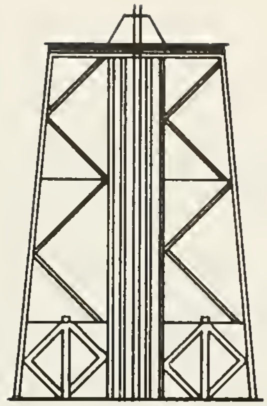
- To gather, analyze, and present information that will aid decisionmakers in the identification and resolution of problems associated with major changes in land and water use.

- To provide better ecological information and evaluation for Department of the Interior development programs, such as those relating to energy development.

Information developed by the Biological Services Program is intended for use in the planning and decisionmaking process to prevent or minimize the impact of development on fish and wildlife. Research activities and technical assistance services are based on an analysis of the issues a determination of the decisionmakers involved and their information needs, and an evaluation of the state of the art to identify information gaps and to determine priorities. This is a strategy that will ensure that the products produced and disseminated are timely and useful.

Projects have been initiated in the following areas: coal extraction and conversion; power plants; geothermal, mineral and oil shale development; water resource analysis, including stream alterations and western water allocation; coastal ecosystems and Outer Continental Shelf development; and systems inventory, including National Wetland Inventory, habitat classification and analysis, and information transfer.

The Biological Services Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams, which provide the Program's central scientific and technical expertise and arrange for contracting biological services studies with states, universities, consulting firms, and others; Regional Staff, who provide a link to problems at the operating level; and staff at certain Fish and Wildlife Service research facilities, who conduct inhouse research studies.



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March 1978

Environmental Planning for Offshore Oil and Gas

Volume V: Regional Status Reports

Part 2: Mid and South Atlantic

by

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Environmental Planning for Offshore Oil and Gas

Volume I: Recovery Technology

Volume II: Effects on Coastal Communities

Volume III: Effects on Living Resources and Habitats

Volume IV: Regulatory Framework for Protecting Living Resources

Volume V: Regional Status Reports:

Part 1: New England

Part 2: Mid and South Atlantic

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ENVIRONMENTAL PLANNING FOR OFFSHORE OIL AND GAS

FOREWORD

This report is one in a series prepared by The Conservation Foundation for the Office of Biological Services of the U.S. Fish and Wildlife Service (Contract 14-16-0008-962). The series conveys technical information and develops an impact assessment system relating to the recovery of oil and gas resources beyond the three-mile territorial limit of the Outer Continental Shelf (OCS). The series is designed to aid Fish and Wildlife Service personnel in the conduct of environmental reviews and decisions concerning OCS oil and gas development. In addition, the reports are intended to be as helpful as possible to the public, the oil and gas industry, and to all government agencies involved with resource management and environmental protection.

Oil and gas have been recovered for several decades from the Outer Continental Shelf of Texas, Louisiana and California. In the future, the Department of the Interior plans to lease more tracts, not only off these coasts, but also off the frontier regions of the North, Mid- and South Atlantic, eastern Gulf of Mexico, Pacific Northwest and Alaska. Within the set of constraints imposed by the international petroleum market (including supply, demand and price), critical decisions are made jointly by industry and government on whether it is advisable or not to move ahead with leasing and development of each of the offshore frontier areas. Once the decision to develop a field is made, many other decisions are necessary, such as where to locate offshore platforms, where to locate the onshore support areas, and how to transport hydrocarbons to market.

Existing facilities and the size of the resource will dictate which facilities will be needed, what the siting requirements will be, and where facilities will be sited. If the potential for marketable resources is moderate, offshore activities may be staged from areas already having harbor facilities and support industries; therefore, they may have little impact on the coast adjacent to a frontier area. An understanding of these options from industry's perspective will enable Fish and Wildlife Service personnel to anticipate development activities in various OCS areas and to communicate successfully with industry to assure that fish and wildlife resources will be protected.

The major purpose of this report is to describe the technological characteristics and planning strategy of oil and gas development on the Outer Continental Shelf, and to assess the effects of OCS oil and gas operations on living resources and their habitats. This approach should help bridge the gap between a simple reactive mode and effective advanced planning--planning that will result in a better understanding of the wide range of OCS activities that directly and indirectly generate impacts on the environment, and the countermeasures necessary to protect and enhance living resources.

Development of offshore oil and gas resources is a complex industrial process that requires extensive advance planning and coordination of all phases from exploration to processing and shipment. Each of hundreds of system components linking development and production activities has the potential for adverse environmental effects on coastal water resources. Among the advance judgements that OCS planning requires are the probable environmental impacts of various courses of action.

The relevant review functions that the Fish and Wildlife Service is concerned with are: (1) planning for baseline studies and the leasing of oil and gas tracts offshore and (2) reviewing of permit applications and evaluation of environmental impact statements (EIS) that relate to facility development, whether offshore (OCS), near shore (within territorial limits), or onshore (above the mean high tidemark). Because the Service is involved with such a broad array of activities, there is a great deal of private and public interest in its review functions. Therefore, it is most valuable in advance to have some of the principles, criteria and standards that provide the basis for review and decisionmaking. The public, the offshore petroleum industry, and the appropriate Federal, state, and local government agencies are thus able to help solve problems associated with protection of public fish and wildlife resources. With advanced standards, all interests should be able to gauge the environmental impacts of each OCS activity.

A number of working assumptions were used to guide various aspects of the analysis and the preparation of the report series. The assumptions relating to supply, recovery, and impacts of offshore oil and gas were:

1. The Federal Government's initiative in accelerated leasing of OCS tracts will continue, though the pace may change.

2. OCS oil and gas extractions will continue under private enterprise with Federal support and with Federal regulation.

3. No major technological breakthroughs will occur in the near future which could be expected to significantly change the environmental impact potential of OCS development.

4. In established onshore refinery and transportation areas, the significant impacts on fish and wildlife and their habitats will come from the release of hydrocarbons during tanker transfers.

5. A significant potential for both direct and indirect impacts of OCS development on fish and wildlife in frontier areas is expected from site alterations resulting from development of onshore facilities.

6. The potential for onshore impacts on fish and wildlife generally will increase, at least initially, somewhat in proportion to the level of onshore OCS development activity.

The assumptions related to assessment of impacts were:

1. There is sufficient knowledge of the effects of OCS development activities to anticipate direct and indirect impacts on fish and wildlife from known oil and gas recovery systems.

2. This knowledge can be used to formulate advance criteria for conservation of fish and wildlife in relation to specific OCS development activities.

3. Criteria for the protection of environments affected by OCS-related facilities may be broadly applied to equivalent non-OCS-related facilities in the coastal zone.

The products of this project--reported in the series Environmental Planning for Offshore Oil and Gas--consist of five technical report volumes. The five volumes of the technical report series are briefly described below:

Volume I — Reviews the status of oil and gas resources of the Outer Continental Shelf and programs for their development; describes the recovery process step-by-step in relation to existing environmental regulations and conservation requirements; and provides a detailed analysis for each of fifteen OCS activity and facility development projects ranging from exploration to petroleum processing.

Volume II Discusses growth of coastal communities and effects on living resources induced by OCS and related onshore oil and gas development; reports methods for forecasting characteristics of community development; describes employment characteristics for specific activities and onshore facilities; and reviews environmental impacts of probable types of development.

Volume III Describes the potential effects of OCS development on living resources and habitats; presents an integrated system for assessment of a broad range of impacts related to location, design, construction, and operation of OCS-related facilities; provides a comprehensive review of sources of ecological disturbance for OCS related primary and secondary development.

Volume IV Analyzes the regulatory framework related to OCS impacts; enumerates the various laws governing development offshore; and describes the regulatory framework controlling inshore and onshore buildup in support of OCS development.

Volume V In five parts, reports current and anticipated OCS development in each of five coastal regions of the United States: New England; Mid and South Atlantic: Gulf Coast; California; and Alaska, Washington and Oregon.

John Clark was The Conservation Foundation's project director for the OCS project. He was assisted by Dr. Jeffrey Zinn, Charles Terrell and John Banta. We are grateful to the U.S. Fish and Wildlife Service for its financial support, guidance and assistance in every stage of the project.

William K. Reilly
President
The Conservation Foundation

PREFACE

This report is one of five regional reviews, the fifth volumes in a series of background reports on the impacts of Outer Continental Shelf (OCS) oil and gas recovery sponsored by the U.S. Fish and Wildlife Service, Office of Biological Services, and prepared by The Conservation Foundation (under Contract 14-16-0008-962). The five reviews are: New England, Mid and South Atlantic, Gulf Coast, California, and Alaska, Washington and Oregon. Other volumes in the series and the overall purposes of the OCS project are described in the Foreword.

The regional reports focus on past and potential impacts on living resources and on their habitats in each region. They also highlight prominent coastal resource-related issues associated with proposed OCS lease sales.

The regional reports present brief overviews of the status of offshore oil and gas activities and impacts for the selected regions. They are meant to inform U.S. Fish and Wildlife Service employees and other interested persons outside the subject region who wish to be generally knowledgeable about the status of OCS around the country and both past and anticipated effects on living resources of the region.

The reports were prepared by analysts who are recognized for their expertise in OCS impacts or coastal zone management. The contents and organization of the reports are as consistent as possible given regional differences in subject matter and differences in the authors' approaches. Each study has five sections:

1. The initial section of each regional report is a discussion of past and present OCS production. This provides a historical perspective that establishes a setting for the remaining sections. Statistics on lease sales, production and reserves are important topics in this section.

2. The second section describes OCS development and future potential, including industry activities, the present leasing schedule and anticipated future projects. This section varies depending upon the amount of anticipatory investigation completed by public agencies and industry.

3. The third section discusses the effects on living resources of activities that accompany OCS petroleum development. A majority of these concerns occur near shore or onshore, where resource values and high impact potential are concentrated. The relative importance of particular habitats

and living resources vary by region. For example, shellfish may be of paramount concern in one region, birds in a second region, and coastal marshes and wetlands in a third region.

4. The fourth section concerns socio economic impacts. These issues are generally treated in less detail, because living resources is the primary subject of the project and the socio economic impact information is only to provide a working background. Since socio economic impacts have been the subject of many other studies, and interest in most areas has centered on socio economic rather than living resource impacts, there is extensive information elsewhere on this subject. Two major topic areas are included in each report: effects of anticipated development and regional interest in OCS.

5. The fifth section is regional information analysis. Publications of regional import are annotated. Each study lists about a dozen publications which contain the best regional research into OCS and related issues.

Each regional report is meant to provide a compilation of information available for the region through midyear 1976.

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1.0 INTRODUCTION

This report covers past, present and future activities related to Outer Continental Shelf (OCS) oil and gas development, onshore impacts and environmental effects for the Mid Atlantic Region and South Atlantic Region.

The main objective of the report is to describe awareness of the ecological systems of the two regions and the potential effects of OCS activity on them. For this purpose, effects of past oil and gas operations, as well as possible future effects on coastal living resources, are reviewed. In order to predict possible effects on the environment, a generalized picture of the ecological systems of the nearshore and onshore regions of the Mid Atlantic and South Atlantic is included in Section 5.

Sections 2 and 3 analyze past and present OCS oil and gas activities in detail, including exploration, lease sales, development, planning for the eventuality of oil/gas finds and possible impacts. Section 4 deals with the future potential of OCS development. Sections 5 and 6 describe likely biological, physical and socio economic impacts which may occur if oil is found in marketable quantities.

Physically, the Mid Atlantic Region, for this report, is taken as that coastal area between New York City and Cape Hatteras, North Carolina. Geologically, the area of prime oil and gas potential on the OCS of this region is concentrated in the Baltimore Canyon Trough, about 40 to 90 miles offshore from New Jersey and Delaware. Historically, the coastline of this area has experienced petroleum industry activity including refining,

tankship construction, and in some instances platform construction. But none of that activity is related to OCS development in the Baltimore Canyon, and hence is not the subject of this report.

The South Atlantic Region is the coastal area between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Geologically, two areas are of concern to oil and gas firms. First, the Southeast Georgia Embayment, culminating in the Cape Fear Arch offshore of the North Carolina/South Carolina border, and second, the Blake Plateau, an area from 150 to 300 miles offshore of Jacksonville, Florida in over 2000 feet of water.

Citations to bibliographic references are noted in the following form: (reference number, page citation) e.g., (2,p.25).

2.0 PAST AND PRESENT OCS PRODUCTION - MID ATLANTIC REGION

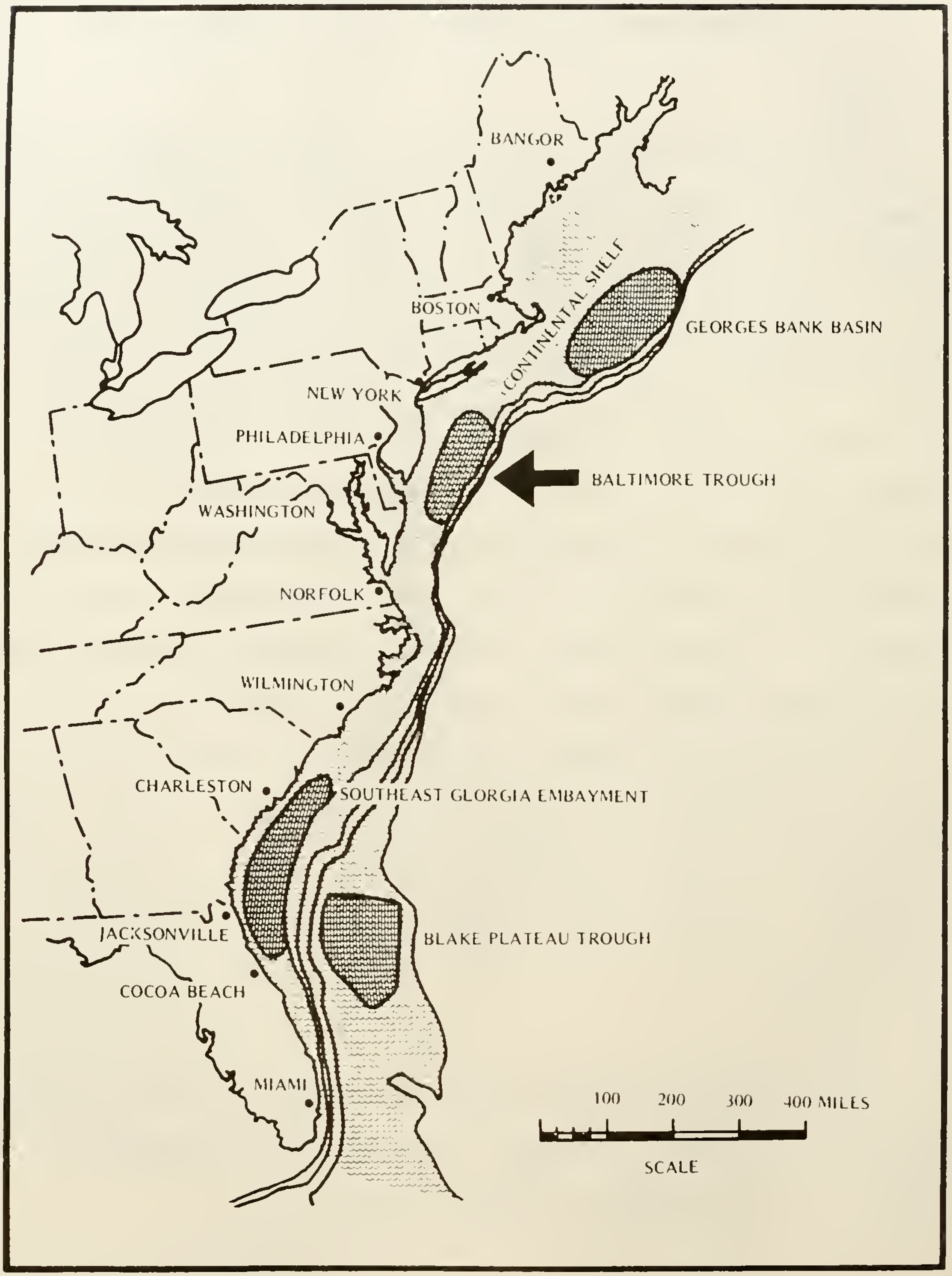
2.1 FIELDS

The Mid Atlantic OCS region, commonly known as the Baltimore Canyon Trough, extends generally from offshore New York to the North Carolina Capes and lies about 40 to 100 miles offshore (Figure 1). This area is about 85 miles wide and 150 miles long. Within this large offshore region, a series of tracts has recently (August 17, 1976) been leased to companies interested in exploration for the possible oil and gas deposits. The 154 tracts proposed for leasing encompassed 876,750 acres (1,p.1) and lay from 54 to 109 miles offshore Delaware and New Jersey in waters from 117 to 571 feet deep. Ultimately, bids were submitted for 101 tracts; 93 were accepted by the Bureau of Land Management (2,p.1), lying in water depths ranging from 131 to 607 feet and are located 47 to 92 miles offshore. These tracts are located approximately between Barnegat, New Jersey, and Rehoboth Beach, Delaware. The sites chosen by industry are those tracts which, based on extensive geophysical exploration, hold the greatest prospect for sizable oil and gas finds.

2.2 YIELDS

There have been no past or present yields of oil or gas from the Mid Atlantic OCS region. Projected future yields are presented in Section 4 - OCS Development and Future Potential.

Figure 1. Location of potential Atlantic oil and gas resources (Source: Reference 1).



2.3 OCS DEVELOPMENT AND PRODUCTION METHODOLOGY

With regard to past or present OCS oil and gas production, there has been no use made of development or production methodology. The only activity has been in the Baltimore Canyon Trough, and this consisted of one COST (Continental Offshore Stratigraphic Test) well sponsored by a consortium of 31 oil and gas companies to determine the prospects of resource recovery (8,p.4).

This initial east coast well was drilled to a depth of 16,000 feet by Sedco J semi-submersible drilling platform and was located 73.6 miles off the New Jersey Coast in the Baltimore Canyon. The well was started December 14, 1976 (6,p.20). A hypothetical OCS development schedule after lease sale is held is presented in Figure 2.

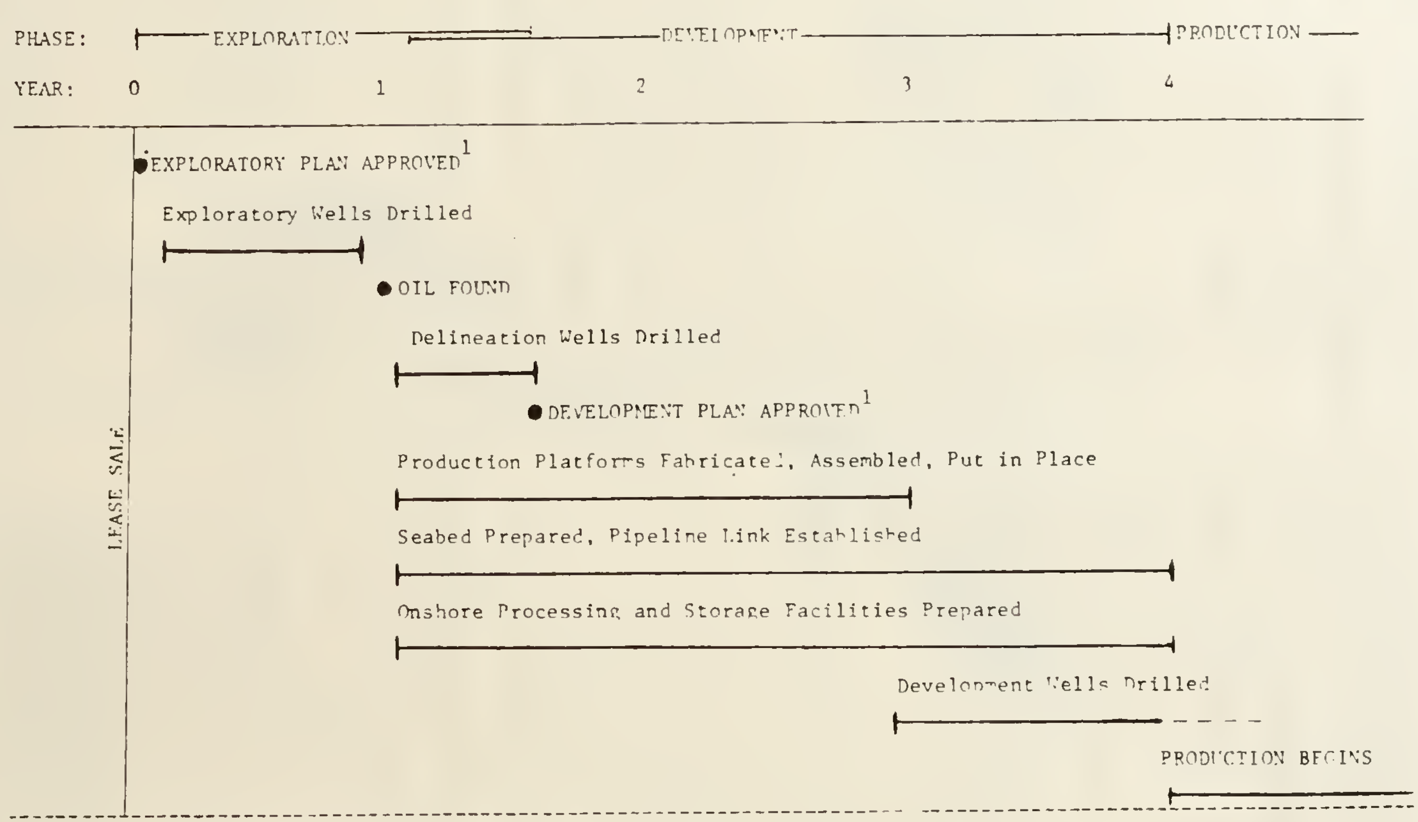
2.4 ONSHORE SUPPORT FACILITIES

Past OCS exploratory activity in the Mid and South Atlantic consisted of seismographic surveys and some limited stratigraphic drilling. Onshore support facilities for such activities consist of shipyards, pipe supply yards, and personnel and logistic support bases. These activities have been carried out by contractors with experience in these specialized skills who are generally located on the United States Gulf Coast or in major ports throughout the world. Thus, no new onshore support facilities have been required for past OCS activity in this study region. Early support for exploratory drilling of blocks leased in sale no. 40 will probably be provided from Davisville, Rhode Island.

2.5 PROCESSING/DISTRIBUTION NETWORK

No new processing or distribution facilities have been constructed in the Atlantic OCS region, nor will such facilities be designed until offshore

Figure 2. Hypothetical OCS development schedule after lease sale is held (Source: Reference 44).



[1] Environmental Impact Statement may be required, at USGS option.

NOTE: This flow chart depicts the time sequence involved in the development of a hypothetical OCS oil field. For purposes of clarity, we have simplified an admittedly complex and variable series of events with the following assumptions: 1) in this case, commercial quantities of oil are found 1 year after the lease sale; 2) capital and equipment are readily available; 3) production begins 4 years after the lease sale.

reserves and production levels have been fully determined. If sufficient resources are discovered crude oil will probably be transported by buried pipeline connecting offshore production areas with onshore storage/distribution systems; otherwise tankers and terminals will be used. The need for extensive new distribution and processing facilities will depend on the quantity of crude and the demand. New facilities will probably not be required since offshore United States oil is intended to replace imported Middle East crude, and since the expected rate of growth of petroleum products demand for the United States East Coast could be handled by expansion of existing refineries (9,p.44).

Depending on where pipelines come ashore, some additional connections to existing refineries in Delaware Bay, Chesapeake Bay, or northern New Jersey will be required. Natural gas pipelines exist in some locales which could be used to transfer gas from the coastal zone processing sites to inland centers; among these locations are: Northern New Jersey-Sandy Hook area, Southern New Jersey-Atlantic City and Cape May, Northern Delaware and the Norfolk-Virginia area. Crude oil pipelines do not extend to or near the Mid Atlantic coastal zone. Thus, if oil is brought ashore by pipeline, new rights-of-way and pipelines will be necessary from landfalls to regional crude pipelines (12,p.15).

2.6 ENVIRONMENTAL CONCERNS

Activities which have taken place so far in regard to OCS exploration in the Mid Atlantic area have produced few if any environmental problems such as minor oil spills, dredge spoil disposal, onshore construction of support facilities, or the laying of pipelines through estuarine marshes.

Of particular concern to the Mid Atlantic region are the remaining productive wetlands of New Jersey, Delaware, Maryland and Virginia. These

marshlands are a valuable nursery and spawning area for most estuarine and nearshore fish and shellfish. Commercial and sport fishing are major regional industries here that could be affected. Also, such areas are important as buffer zones against storms, are feeding areas for migratory waterfowl, and support a vast diversity of flora and fauna.

The possible effects of OCS activities, such as spills, on offshore fisheries may present a major problem. The offshore areas of the Mid Atlantic states are heavily used for sport and commercial fishing, important species being: marlin, bluefish, striped bass, menhaden, flounder, sea bass, weakfish, mackerel, hake, surf clams, hard clams, blue crab, oysters, and lobster (23).

Comments made by the Natural Resources Defense Council in regard to the Environmental Impact Statement for OCS Lease no. 40, Baltimore Canyon, reveal the following possible areas of environmental concern. These possible effects are discussed in detail in Section 5. No assertion as to whether and to what degree these problem areas might arise is made.

1. Lack of baseline biological data on: phytoplanktonic populations, zooplanktonic relationships with phytoplankton, spawning characteristics of fish, impact of sublethal oil on fish, life history of commercially significant fish, effects of turbidity and resuspension of toxic materials due to pipeline laying. Some effort is being made to correct deficient data by BLM sponsorship of a baseline study of the Mid Atlantic OCS. VIMS is the contractor for this study.

2. Lack of impact assessments of oil pollution on plankton, commercial and sport fishing, nursery areas in estuarine wetlands.
3. Possible problems with subsidence potential, bottom sediment transport, changes in water circulation patterns, beach erosion and wetland soil instabilities.
4. General onshore impacts, such as use of wetlands and farmlands for facilities, degradation of air quality from hydrocarbon processing plants and enlarged refineries, effects of oil spills, effects of increased tanker traffic, and generalized socio economic, recreational, and aesthetic impacts (10).

3.0 PAST AND PRESENT OCS PRODUCTION - SOUTH ATLANTIC REGION

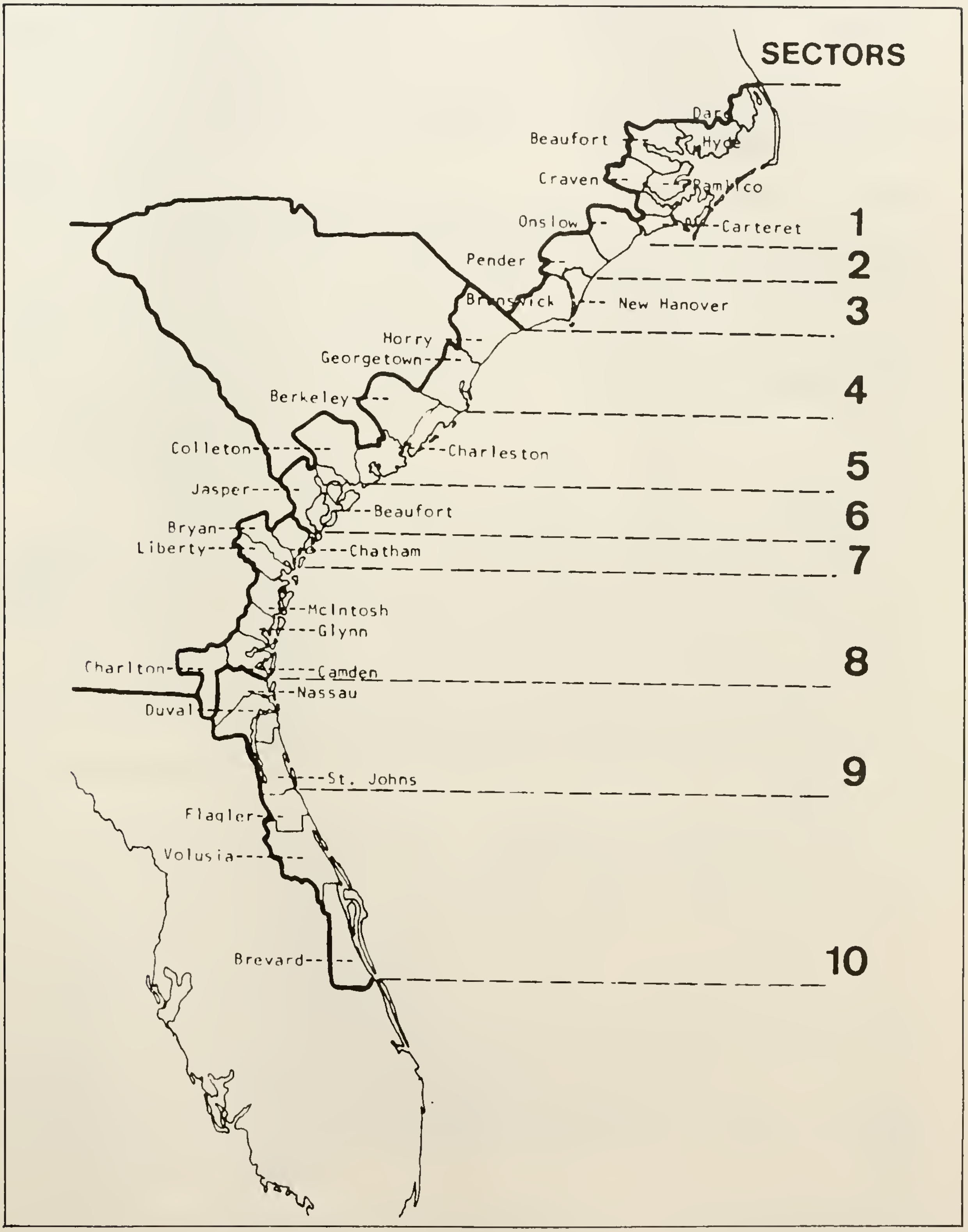
3.1 FIELDS

The South Atlantic OCS region, offshore of North and South Carolina, Georgia, and Northeastern Florida is officially called the South Atlantic/ Georgia Embayment OCS area (3,p.1). In this offshore area, the best chances for oil discoveries are given to an area called the Blake Plateau, which is approximately 100 miles offshore. Depths of water above this geologic structure range from 1,000 to 3,000 feet (4,p.20). The second best area for proposed offshore oil exploration is the Georgia Embayment, a semicircular-shaped area extending from Central South Carolina to Northeastern Florida. This area varies from 15 to 60 miles offshore. These two regions comprise BLM Sale No. 43, which was tentatively set for December, 1976 (5,p.2), although speculation is that lease sales here will be delayed until late 1977 (6,p.20).

The South Atlantic OCS region coastal counties which will be most involved in OCS oil and gas development are shown in Figure 3. The two fields in this region, the Blake Plateau and the Southeast Georgia Embayment, are shown in Figure 1.

In the OCS region offshore of the Carolinas and Georgia, the petroleum potential is most favorable beneath the Blake Plateau, Southeast Georgia Embayment, Hatteras Embayment and the flanks of the Cape Fear Arch, in that order (1,p.15). Outer Continental Shelf areas under consideration for leasing

Figure 3. Map of the South Atlantic study area (Source: Reference 26).



by the Department of the Interior in the South Atlantic are presently confined to the Blake Plateau and Southeast Georgia Embayment (16). Little information is available for the Hatteras Embayment or Cape Fear Arch. Off the shore of Georgia, the Continental Shelf extends for 80 to 85 miles. The water depth at the top of the Florida-Hatteras Slope is approximately 600 feet. The Continental Shelf slopes very gently from the edge of the mainland shore to the Florida-Hatteras Slope. From there it drops rapidly to the Blake Plateau, which has been described as a broad platform extending from the tip of the Straits of Florida to Cape Lookout where it merges with the Continental Slope. It is thought that there are from 8,400 to 16,500 feet of sedimentary rocks in the basin under the plateau out to a water depth of 1,800 feet (42). The Southeast Georgia Embayment is a structural feature underlying part of the coastal plain region of Georgia and extending out into the ocean for an unknown distance. Recorded maximum sedimentary thicknesses near the center of the embayment exceeds 5,000 feet; offshore near the edge of the Continental Shelf, sedimentary rocks are thought to be more than 10,000 feet thick (17,p.174).

3.2 YIELDS

There has been no past offshore or onshore production of oil and gas in North Carolina, South Carolina, and Georgia (18,p.17). Both oil and natural gas are produced from onshore fields in Florida where commercial quantities of petroleum were discovered in 1943. The major producing field in Florida is located at Jay in the northwest part of the state. Six small fields are located in the southwest part of the state, but there are no onshore fields near or adjacent to the Southeast Georgia Embayment (19,p.20).

Offshore activity in the South Atlantic OCS is limited to exploratory geophysical survey work and planning for stratigraphic drilling. There is no commercial production in this OCS region as of the end of 1976.

Projected future yields are presented in Section 4-OCS Development and Future Potential.

3.3 OCS DEVELOPMENT AND PRODUCTION METHODOLOGY

As of the end of 1976, no development or production methodology has been employed in the South Atlantic OCS. Seismic studies have been conducted during the spring and summer of 1976 (5,p.20), but developments have not progressed beyond that point.

3.4 ONSHORE SUPPORT FACILITIES

Due to the lack of exploratory or production drilling in the South Atlantic OCS region, no specialized onshore support facilities have been built or used in the past. Seismographic surveys have been completed by subcontractors who specialize in such work, and their small ships require only minimal onshore support in the form of fuel, food, and infrequent dock space. All such support facilities are readily available in most medium-sized ports. No COST wells have been drilled in the South Atlantic OCS (5), although one exploratory well was completed offshore of Jacksonville in 1976 (31).

3.5 PROCESSING/DISTRIBUTION NETWORK

No new processing or distribution facilities have been planned for or constructed in the South Atlantic OCS region, nor will such facilities be designed until offshore fields have been delineated and reserves determined.

3.6 ENVIRONMENTAL PROBLEMS

Anticipated environmental problems are presented in detail in Section 5;

generalized areas of concern are presented here.

Since there have been no offshore development activities in the study area, there have not as yet been adverse environmental impacts.

Of particular concern are the expansive undeveloped wetlands and sea islands which span the nearshore zone of all the states in the South Atlantic Coastal zone. These productive marshes are highly valuable in maintaining commercial fisheries of shrimp, crabs, clams, finfish and oysters. Also, such areas are important as buffer zones against storms, protective feeding and breeding grounds for wildlife and waterfowl, nutrient sources for primary producers, and, in general, are the base support for the entire estuarine ecosystem (20).

Potential coastal zone effects of OCS-related operations (dredging, pipeline laying, platform construction, support ship operations) may include the following (41):

a. Disruption of nearshore and estuarine habitats;

b. Chronic pollution of local water masses by oil or suspended solids;

c. Decrease in primary and secondary productivity and loss of commercial fishing potential;

d. Disruption of local marsh structure;

e. Creation of navigation and fishing hazards;

f. Adverse effects of oil spills on regional biota.

Some potential offshore environmental impacts which have received attention in the BLM OCS Environmental Studies Program (21) are related to drilling, platform operation, pipeline construction, and oil and gas recovery. Such potential impacts are:

a. Disruption or alteration of marine habitat;

b. Oiling or lethal effects of oil spills on fish, waterfowl and seabirds;

c. Toxic or sublethal effects on marine organisms from chronic pollution;

d. Disruption of commercial fishing;

e. Creation of navigation hazards;

f. Creation of sport fishing habitat.

4.0 OCS DEVELOPMENT AND POTENTIAL

4.1 POTENTIAL

Potential (undiscovered) recoverable offshore crude oil resources for the Mid and South Atlantic regions have been estimated by the USGS as 2 to 4 billion barrels of oil (7,p.29). The lower limit of this range represents the 95% probability level of discovery while the upper limit represents the 5% probability level. Potential natural gas reserves were estimated by the same agency as 5 to 14 trillion cubic feet of gas within the 95% and 5% probability levels with a statistical mean of 10 trillion cubic feet (1,p.31).

These estimates apply to continental shelf margins of the states from New York to the Florida east coast. The continental shelf is defined in this instance as waters up to 630 feet in depth since it was felt by USGS that technology and economics allowed for ready exploration of offshore areas up to these depths (7,p.15).

USGS estimates of 1975 are lower than earlier estimates of oil and gas resources of 10 to 20 billion barrels and 55 to 110 billion cubic feet, respectively, made in 1974. For the South Atlantic OCS region, the Office of Technology Assessment has estimated recoverable reserves as 0 to 1.3 billion barrels of oil and 0 to 2.5 trillion cubic feet of gas (9).

Other estimates of potential resource yields add to the divergence of opinions. The American Petroleum Institute has estimated an upper limit of

oil and gas recovery for the OCS area between New York and North Carolina as 6 billion barrels of oil and 32 trillion cubic feet of gas (of which 6 trillion cubic feet would be recovered in association with crude oil)(12,p.11).

Comparison of potential recoverable oil and gas resources for the Mid and South Atlantic OCS with those of currently producing OCS regions is important in establishing the level of activity which may occur in the study area. For example, the past cumulative production of oil and gas (through December, 1974) for the Western Gulf of Mexico OCS is 6 billion barrels of oil and 67 trillion cubic feet of gas. For the Southern California OCS, production figures are 3 billion barrels of oil and 2 trillion cubic feet of gas (7,p.32). The estimated undiscovered recoverable oil and gas resources for the entire United States, onshore and offshore, are 36 to 81 billion barrels of crude oil and 286 to 529 trillion cubic feet of natural gas.

Potential yields of the first lease sale (No. 40) in the Baltimore Canyon Trough are described by the BLM (1,p.3) as:

> The U.S. Geological Survey (USGS) estimated in September, 1975, based on proprietary geophysical data, that the undiscovered recoverable resources of the 154 tracts included in the proposed lease sale area range from 0.4 to 1.4 billion barrels of oil and 2.6 to 9.4 trillion cubic feet of gas.
>
> Based on the Geological Survey's estimates of the potential undiscovered resources of the 154 tracts (876,750 acres) proposed for sale, the peak production could range from 90 to 320 thousand barrels of oil per day and from 0.85 to 3 billion cubic feet of gas per day, peaking approximately 10 years after production has commenced.

4.2 EXPLORATION ACTIVITIES

Geophysical survey activities have been carried out in each of the three major Atlantic OCS regions (Georges Bank, Baltimore Canyon, and Southeast Georgia Embayment), although most operations have concentrated

on the Baltimore Canyon due to the execution of the August, 1976 lease sale in that area. Few activities other than seismographic surveys have been carried out in the South Atlantic area, whereas past exploration activities in the Mid Atlantic OCS area have included COST wells. Such action is commonly carried out by private contractors who may work for one or several oil companies at a time, or who may undertake the surveys of likely oil-bearing structures themselves and sell the resultant data to any interested parties. This type of activity requires no new shore-based facilities. Seismic vessels operate out of existing ports and may conduct tests anywhere in the world.

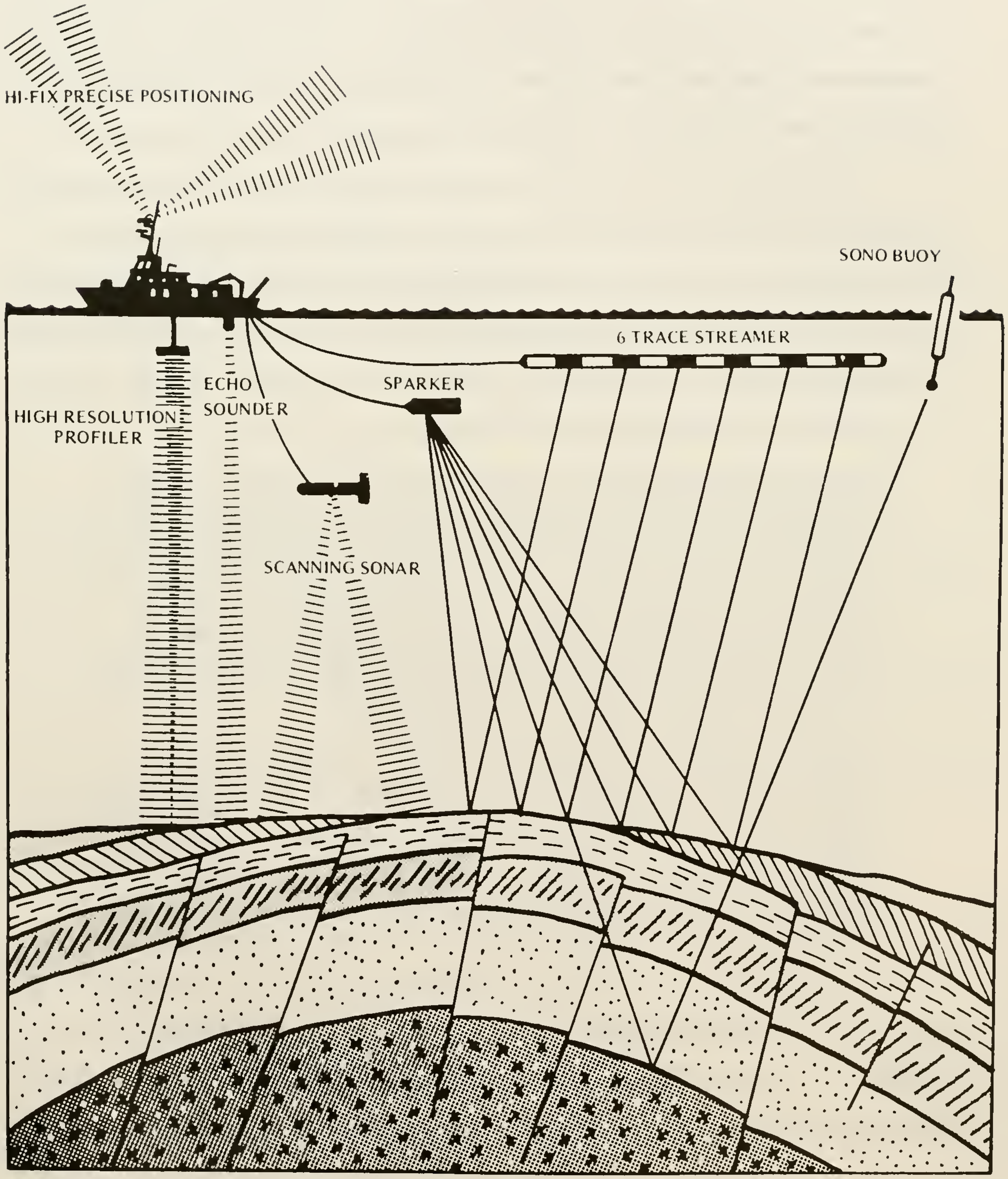
The manner of geophysical exploration is described as follows:

> Geophysical surveying uses small shock waves set off near the water surface and sensitive recording devices towed behind small vessels to determine the density of sediments lying thousands of feet beneath the ocean bottom. Geophysicists interpret the results of these surveys to predict where oil and gas deposits are likely to be found. (13,p.15). (Figure 4).

More recent exploration activities have consisted of the drilling of a COST (Continental Offshore Stratigraphic Test) well in the Baltimore Canyon. This well which was started in December, 1975 and lies 73.6 miles off the New Jersey coast is the first step of a major program to collect actual subsurface information in offshore frontier areas (6,p.20). Exploratory wells are drilled, in this case, by semi-submersible drilling rigs which operate out of home ports (especially from the Gulf) and are used world-wide whenever needed. Little onshore support other than supplies, some personnel quarters (usually motels), fuel and food are needed.

These deep test wells are part of a comprehensive program to find out what type of potential reservoir and source rock lies in sedimentary basins

Figure 4. Geophysical survey methods
(Source: U.S. Department of the Interior).



of the area. A total of about 35 million dollars has been spent by oil firms through early 1976 in exploratory activity on the Atlantic Outer Continental Shelf. Less than one-third of this amount was expended on the South Atlantic region (5,p.19), with data acquisition efforts for the Southeast Georgia Embayment receiving the lion's share mainly since the Blake Plateau area isn't scheduled for a lease sale until mid-1978 and lies in deeper water.

Exploratory drilling follows lease sales, such drilling being done by sophisticated drill rigs. The three most commonly used types of rigs are semi-submersible, jack-up, or floating drill ships. Such drill rigs either move to the site under their own power or are towed to the designated field from existing ports or oil fields. The expected sequence of exploration activities is explained by Goodman (13,p.17):

> The rigs are towed to the lease holdings from any of a number of worldwide locations. Support materials are usually stored onshore: drill pipe, drill bits, drilling mud (powder), cement (powder), casing (pipe), catered foods, crews, tools, etc. Transportation to drilling sites is provided by locally-berthed work boats (LOA up to 200-250 feet), crew boats (LOA up to 85-110 feet), and helicopters. Repair facilities, divers, ship chandlers, welders, mechanics, and other ancillary support usually locate in the immediate area to provide their special services, many of which are common trades.
>
> Exploratory drilling continues until the limits of the total field are defined. The number of exploratory wells required depends on the geological structure. The U.S. Geological Survey of the Department of the Interior regulates the procedures for drilling and for numerous other activities related to completion, platform installation, pipelines and other OCS operations by publishing "OCS Operating Orders" and by conducting inspections of facilities and operations.

The Atlantic areas in general pose no known serious drilling problems. Water depths are shallow to moderate (600 feet), and weather may be classed as moderate to severe, although storm conditions in the South Atlantic may be extremely severe on rare occasions. Most semi-submersible drill rigs will

probably be able to work year-round, while smaller semi's, drill ships, and jack-up rigs might work seasonally. Exploratory semi-submersible rigs capable of drilling in the Southeastern Georgia Embayment waters up to 300 feet deep are currently working in the Gulf of Mexico and could easily be moved to the new OCS region (5,p.21). Drilling in the 1,000 foot depths of the Blake Plateau will require development of structures and techniques not yet in use in other offshore areas.

Some exploratory drilling such as COST holes, may be undertaken by a consortium of oil companies to determine the nature of the structure as earlier indicated by geophysical data. Often, however, lease sales are held before any drilling is completed in the projected geological structure, and bids are based on information gathered from remote geophysical surveys.

Estimates have been made that from 5 to 20 drilling rigs would be operating simultaneously in exploratory phases following OCS Sale No. 40 - Baltimore Canyon Trough (1, Vol. 11,p.4). About five acres of coastal land are required for logistic support for terminal operations, storage, and technical support of each exploratory rig. Also estimates on the work force complement required for 10 rigs have been placed at about 260 people, of which about 220 would be rig crew members and would largely come from existing Gulf operations.

In the South Atlantic, it has been estimated that 5 to 10 exploratory rigs will be operating simultaneously (41).

4.3 LEASING

The OCS Lease Sale No. 40 - Offshore of the Mid Atlantic States - took place on August 17, 1976. Geophysical data are used as a basis for requesting which blocks are put up by BLM for leasing. Also, interested parties such as

fishermen, shipping interests, the military, environmentalists, and others, request that certain blocks not be leased due to some significant restrictions such as major bottom fish or shellfish concentrations. Successful high bidders purchase the exclusive right for 5 years to explore for and develop oil and gas resources on 3 square mile tracts. If they do not actively explore for oil and gas and put it into production, the lease expires and returns to the U.S. government.

For the Mid Atlantic, the entire sequence of choosing and leasing tracts is explained clearly by a BLM News Release (14):

> A tentative list of 154 tracts totaling 354,816 hectares (876,750 acres) is being made available for a proposed sale of oil and gas leases (OCS No. 40) on the Mid Atlantic Outer Continental Shelf, the Department of the Interior's Bureau of Land Management announced today.
>
> This proposed sale is tentatively scheduled for May 1976.
>
> On March 26, 1975, the Bureau of Land Management asked industry to nominate tracts on which it would like to bid if a sale is held, and also invited other Federal agencies, State and Local governments, environmental groups, and the general public to specify tracts which, in their view, should not be offered in the proposed sale.
>
> The Mid Atlantic area considered in the call for nominations consisted of 1,151 tracts totaling 2.6 million hectares (6.5 million acres). Industry expressed interest in 557 tracts totaling 1.3 million hectares (3.2 million acres).
>
> BLM's recommendation of 354,816 hectares (876,750 acres) was based upon environmental protection and other resource uses, coastal State government concerns, and areas of high interest in oil and gas potential.
>
> Not included in the tentative tract selection list are 71 tracts which the commercial fishing industry requested be eliminated from lease consideration. The decision to eliminate these tracts from the proposed sale offering was made after the fishing industry recommendation was supported by the U.S. Fish and Wildlife Service of Interior, the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NOAA) in Commerce, and the views of coastal states.
>
> None of the area now being considered conflicts with known ocean dumping areas.

Of the 154 tracts offered, BLM received 101 bids; 93 were accepted. The eight rejected bids were for tracts BLM considered more valuable than the highest bid received (2,p.1).

Lease sales for the South Atlantic OCS region were originally planned by BLM for November, 1976 (14,Fig.2), but this schedule was not met due to various legal and environmental delays. Most likely, tracts will be offered for sale late in 1977, after the completed Draft Environmental Impact Statement has been reviewed by all parties concerned and all comments and problem areas are resolved.

4.4 PLANNING FOR PRODUCTION

Planning in anticipation of oil and gas production in the Mid and South Atlantic OCS has been carried on for many years and along several fronts. A typical production scenario for consideration in the planning process is described in (8):

> The production phase includes offshore platform construction and erection; pipeline construction; more extensive development drilling (sometimes as many as 40 holes per platform); construction and installation of production equipment, including "Christmas trees" (the complex arrangement of valves that control product flow and facilitate the reworking of a well), and other related devices on the platforms or the bottom; construction of processing units offshore for separating sand, water and gas from oil, and onshore for stripping heavier fractions from oil; and finally, maintenance operations that keep the wells flowing. It is important to remember that the term "production" does not include processing activities such as refining.

Under normal circumstances, transportation to shore of crude oil from platforms at sea takes place through pipelines. Large diameter pipe (generally greater than 12-inch diameter) is welded together from short sections (40 feet long) on a barge and allowed to sag under its own weight to the sea

floor. (In deeper water, a curved pipe support called a "stringer" trails behind the lay-barge). In water depths less than 200 feet, USGS requires that in the Gulf the pipeline be buried. This is accomplished by jets of water forcing sediments away from the pipe, allowing the pipe to settle in the resulting trench. The disturbed sediments, after they settle, partly cover the pipe, but complete burial requires additional time (usually more than a year in deep waters). Complete burial may be achieved in certain bottom materials by making several passes with the jetting equipment.

To prevent corrosion, pipelines are coated with materials such as epoxy compounds or thick, asphalt-like mastic. If extra weight is needed to keep the line in place or mechanical protection is needed, the pipe is also covered with a layer of dense concrete. As the pipeline comes ashore, it is buried deeply enough to avoid its being exposed by storm-associated beach erosion. Onshore pipelines are buried in trenches (either on upland or marsh).

Planning functions of immediate concern here are those which will influence environmental quality (biological, social, economic, physical). Even within this restricted scope of concern, these functions encompass a broad range of governmental, industrial, and public activities.

Planning for OCS oil development has in general proceeded further, or at least more visibly, in the Mid Atlantic region than in the South Atlantic. As a consequence, most of the observations which are made here are based upon Mid Atlantic production planning. However, due to uniformity in national statutory requirements and relative homogeneity of social concerns about OCS development in both Mid and South Atlantic coastal states, the issues observed in the Mid Atlantic may well be representative of issues likely to

develop in the South Atlantic region.

In the Mid Atlantic region there has been a substantial lack of harmony in planning for offshore activity between state and Federal jurisdictions. In most cases these difficulties are cuased by a scarcity of quantitative data on anticipated production and well-field location, the reluctance of energy companies and federal managers (USGS,BLM) to share proprietary geophysical data on likely oil reserves, and the vastly different staffing and operating practices that exist between operating companies. Planning for production from a coastal zone manager's view is difficult and mostly hypothetical until offshore reserves are located, quantified, and the methods of extraction, collection and distribution clarified and operating companies have been identified. It is this feeling of inevitability of offshore development regardless of local interest and inputs that has resulted in a generally negative attitude in the Mid Atlantic coastal zone states. This negative reaction has manifested itself in many ways, i.e., in the comments of state officials (Governor of New Jersey, Secretary of Delaware Department of Natural Resources and Environmental Control, Director of Delaware State Planning Office, etc.), in the comments of special interest constituencies at public hearings such as those held in Trenton, New Jersey, on potential lease sales in the region, and by the formation of political action groups that lend greater weight to the regional publics' interests (i.e. MAGCRC, Mid Atlantic Governors' Coastal Resources Council).

Locational analyses of such major facilities as described above significantly influence uses of coastal zone lands, alignment of pipelines, and demands on local labor markets and infrastructure (water supply, police, sewage treatment, health care, education). Development of onshore facilities also

requires large tracts of land with ready access to the ocean, with the potential for impacting prime ecological, aesthetic, or recreational uses.

4.5 POTENTIAL NEW ONSHORE FACILITIES

The lack of specific information on the size of offshore oil and gas reserves in the Mid Atlantic and South Atlantic OCS Regions affects many decisions of industry as to what types and sizes of onshore facilities will be required and where to locate them.

General types of installations which are required include:

- port services;
- supply boat anchorages;
- staging areas for pipe;
- equipment and provision yards;
- office and general storage buildings;
- ship repair facilities;
- helicopter bases;
- housing for workers and off-duty crews.

If sizable offshore fields are located, it is probable that large-scale facilities would come into play, among them:

- construction yards for drilling/production platforms;
- tank farms for oil storage;
- refineries and associated petrochemical plants.

In the Mid Atlantic region and South Atlantic Region many full service port facilities exist in close proximity to the lease areas which would be able to provide repair services, fuels, oils and other supplies, and equipment staging areas. In the Mid Atlantic these are usually located at the head of major bays or estuaries such as the Delaware or Chesapeake. In the South Atlantic they are more readily accessible to the OCS areas. Developed ports in the Mid Atlantic include New York City, Philadelphia, Wilmington, Baltimore and Norfolk, whereas South Atlantic ports of this designation are Morehead City, Wilmington, Georgetown, Charleston, Savannah, Brunswick, and Jacksonville. Smaller harbors located along the Atlantic shoreline such as

Atlantic City, New Jersey; Cape May, New Jersey; Lewes, Delaware; Ocean City, Maryland and Cape Charles, Virginia would be capable of serving as centers for crew boats and smaller supply needs.

Land needs for an average work boat supply and crew staging area would require about 40 to 60 acres, counting the usual secondary facilities also required (housing, gas stations, roads, etc.)(19,42). Based on estimates made by BLM for the Northeast Gulf area 4 to 5 times that acreage might be required in the general vicinity (several miles radius) of the onshore logistic support site as exploratory operations proceed. Barge, rail, and road access would be required.

The land-use impact of product delivery facilities has been estimated by BLM as being 40 acres for a tanker terminal with 500,000 barrels of storage and 40 acres per pipeline terminal, including 120,000 to 200,000 barrels of storage. The number of such sites will depend on the number and location of pipelines (13,p.28). Due to the unknown levels of oil and gas production which will occur in either the Mid or South Atlantic regions, the numbers, types and locations of onshore facilities are as yet unknown. However, Goodman (13,p.29) states:

> ...based on the estimated level of resource recovery (for the Mid Atlantic OCS area), the total population increase due to exploration, drilling and production activity will probably be about 60,000 people for the entire Mid Atlantic region. Second, the total land use requirement in support of OCS exploration and drilling activity is quite small, about 500 acres; less than 100 acres need be at the water's edge. The requirements for production facilities also would be about 500 acres of land.

In the Mid Atlantic region, certain large land-use activities already have been committed, such as a 2,000 acre land acquisition by Brown and Root in Northampton County, Virginia, intended for platform and pipeline construction. Also, Offshore Services, Inc. is negotiating for a 600-slip

marina near Slaughter Beach, Delaware, to be used as a support facility for drilling activities in the Baltimore Canyon. A large industrial area in Lewes, Delaware is also being mentioned as a large support facility for crew and work boats (27). A number of potential sites for refineries have been identified during the past decade, many of which have met with local opposition (Shell in Delaware is one good example). A large find might act as a stimulus to further interest in locating refineries in this coastal region.

In the South Atlantic, due to the later proposed lease sale (late in 1977), less onshore activity has been planned for than in the Mid Atlantic area. Large ports such as Wilmington, North Carolina; Charleston, South Carolina; Georgetown, South Carolina; Savannah, Georgia; and Jacksonville, Florida, all have many of the facilities required to support offshore activity. The types of facilities needed will depend on where oil (or gas) is found, the reserves, and the economic restraints associated with their extraction and distribution. If a large discovery is made in this region, it is likely that new distribution networks and refineries would be built as explained in the next section.

4.6 PROCESSING AND DISTRIBUTION

The Mid Atlantic region is one of the most densely populated and industrialized areas in the country. This region contains nearly all of the 1.6 million barrels per day refining capacity now located on the U.S. east coast. Potential oil and gas production from the Baltimore Canyon would provide about 10 percent of regional oil and natural gas requirements by 1985 (assuming medium demand and average production) (13). This would represent an important contribution to the region's energy needs but would not substantially offset the expanded need for supplemental energy supplies in the region.

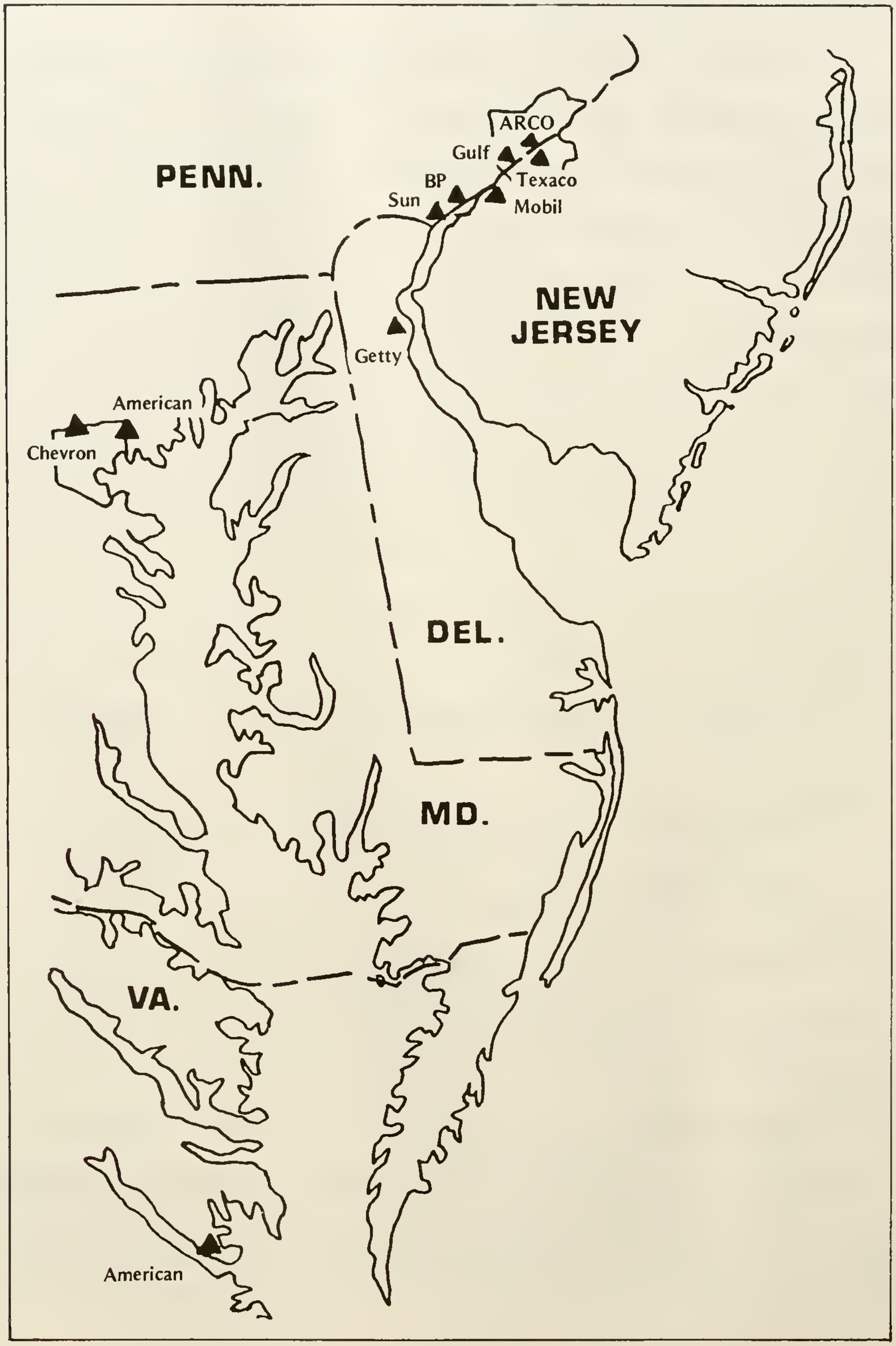
It is expected that new OCS oil and gas sources would somewhat reduce imports of Middle East crude, or at least make up the difference between present import levels and higher future demand.

If production from the Baltimore Canyon is low, then the oil is likely to be transported by tanker and processed in existing or expanded refineries in the industrial belt between Wilmington, Delaware and New York City. Although local environmental impacts may result from refinery expansion, the onshore impacts of low Baltimore Canyon production would be little noticed either positively or negatively. However, if oil production is high, it is likely that new refinery capacity would be required either in the form of expanded existing refineries or newly constructed refineries, (21,p.131). Existing refineries are shown in Figure 5, and their capacities are given below: (28,Vol.3,p.65).

Location	Company	Capacity (bbl per day)
New Jersey:		
Paulsboro	Mobile Oil Co.	100,000
Westville	Texaco Inc.	91,000
Pennsylvania:		
Philadelphia	Atlantic Richfield	160,000
	Gulf Oil Co.	168,500
Marcus Hook	BP	93,200
	Sun Oil	165,000
Maryland:		
Baltimore	Amoco Oil Co.	11,000
	Chevron Asphalt Co.	10,700
Virginia:		
Yorktown	American Oil Co.	51,000
Delaware:		
Delaware City	Getty Oil Co.	140,000

For the South Atlantic area, production of petroleum and petrochemical products is negligible in the 30-county coastal area and in the entire four-state area.

Figure 5. Study area refineries: Mid Atlantic
(Source: Reference 28).



Consumption is estimated for the entire four-state area as 428 million barrels per year, or 1,173,000 barrels per calendar day of refinery throughput, or 1,276 thousand barrels per stream (operating day)(26,p.7).

Demand in the South Atlantic region is equivalent to about five refineries of 250,000 barrels each, and this should grow to about 7 by 1985 and 11 by 2000, independent of offshore drilling production.

Prediction of the economic implications of resources discovered in the South Atlantic region vary widely. Those predicted on lease sale 43 conservatively predict export of crude to Gulf and Mid Atlantic refineries. Others say that the economics of refining and petrochemical production are in the process of change as is the total United States crude oil picture. What is likely to occur is a major shift to imports, large refineries, and large petrochemical complexes in the South Atlantic region, probably in a number of locations, and initially near the four deep ports of Wilmington, Charleston, Savannah and Jacksonville. By the time any offshore drilling production occurs, it will probably merely replace imports, thus firming up supply, and influencing refinery and petrochemical location in the general areas where pipelines are brought ashore (26).

A 7,000-acre site near Savannah (Jasper County) has been acquired by the Chevron Oil Company, and speculation is that this site is to be used for a refinery. Several of the ports in this region have zoning for heavy industry, or have large industries in existence, among them Charleston, Savannah, Georgetown, Wilmington and Jacksonville.

Distribution networks in the form of gas pipelines do exist throughout the four-state South Atlantic region, but oil (crude or product) pipelines are not available. Thus, a large gas find could be accommodated within the

existing distributional network, while a large oil find would require a new pipeline network, new refineries, or transshipment to existing refinery sites further north (Maryland and Delaware).

4.7 TECHNOLOGY ADVANCEMENT NEEDS AND POTENTIALS

The general needs and improved technological requirements which are asked of the oil industry in the Atlantic OCS regions may be listed as: (21,pp.162-172)

(a) Better technology to prevent spills, blow-outs, leaks and ruptures, especially via increased downhole pressure measurement abilities.

(b) Increased ability to work in deep waters; up to 600 feet in the Baltimore Canyon and over 2500 feet on the Blake Plateau.

(c) New developments to allow for use of subsea completion and production facilities.

(d) Ability to work under more severe weather conditions than those experienced in the Gulf of Mexico or in the Santa Barbara Channel.

(e) Minimize loading of oil and other effluents in the aquatic environment until the chronic effects of same have been determined.

(f) Improved structural integrity of drilling platforms to avoid loss to storms.

(g) Minimization of adverse impacts from pipeline burial and from subsea debris which snares fishing gear.

All of the above areas are subjects which are of concern to regional planners, government officials, and environmental groups. The oil industry is facing a different social and physical environment in the Atlantic than that in the Gulf, thus, not only must new technological innovations be forthcoming to minimize pollution potentials, but new techniques and ways of doing things must be instituted to take the different social concerns into consideration.

All frontier OCS areas are similar in their technological and

environmental expectations of the way in which offshore oil and gas resources are exploited. Several areas place greater emphasis on protection of recreational beaches and shore communities (New England, Mid Atlantic, Southern California), although most regions have expressed concern about possible damage to fish and shellfishing resources. All frontier regions expect that OCS activities will be carried out with a minimum of oil spills and a maximum of planning consultation with local and state officials.

5.0 EFFECTS ON LIVING RESOURCES (PAST AND FUTURE)

To date, there has been no significant offshore oil and gas activity other than the drilling of one exploratory stratigraphic test well in the Baltimore Canyon area. Although oil spills and shipwrecks have occurred in the past, with impacts often similar to what might be expected from intense oil and gas activity, there have been no impacts yet from OCS development. The following discussion thus concerns itself with likely impacts as based on knowledge of the existing ecosystems in the Mid Atlantic and South Atlantic OCS regions, and on past experience from other areas where offshore oil and gas activity has been under way for a number of years.

The general impacts of OCS activity on coastal ecosystems should be the same for both the Mid Atlantic and South Atlantic. This premise is based on the overall similarity between the two regions. Both areas are composed of the Atlantic coastal plain, which ranges in width from 20 to 30 miles in northern New Jersey to over 140 miles in North Carolina (23). The coastline of both study areas is one of submergence so that stream valleys are "drowned" and form broad tidal estuaries. The seaward margin is fringed with almost continuous beaches and bars, while landward, nearly continuous marshes border the estuaries. However, whereas the Mid Atlantic coast is fringed by barrier beaches and islands, the coastlines of South Carolina and Georgia are comprised of barrier islands.

Various types of wetland classifications are given by Shaw and Fredine

(36) for the Mid and South Atlantic coastal regions. Whereas the Mid Atlantic region has numerous shallow and open fresh-water marshes and coastal salt meadows, the South Atlantic region has few of these types of marshes. However, the South Atlantic has vast acreages of open sounds and bays, inland fresh-water marshes, swamps, bogs, regularly flooded salt marshes, and irregularly flooded salt marshes. Wetlands value for waterfowl, by state in decreasing order is given as (36): Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Delaware, and New Jersey.

Ecologically, there is only an arbitrary dividing line between the biological communities in the two study regions. Many organisms are distributed over a range wider than the bounds of just the Mid or South Atlantic. Furthermore, certain physical and chemical phenomena occurring in the two study regions are the result of conditions that have developed outside the study area, notably, the Gulf Stream (23,p.0-2).

Not only does the temperature effect of the close-to-shore Gulf Stream play a major role in biological zonation, but the sediment composition also comes into play as a differentiation characteristic between communities north and south of Cape Hatteras. The sandy bottoms of the Carolinian region have a much higher carbonate content than areas north of Cape Hatteras. These sediments support a benthic fauna which replaces some northern species with ones found only in the south, such as the surf clam, *Spisula ravenelli* replacing its northern cousin, *S. solidissima*. Also, there appears to be introduction of new groups and greater diversity of species as one progresses from north to south of Cape Hatteras (23,p.5-9).

From a commercial viewpoint, surf clam harvesting is a major industry in the Middle Atlantic Bight, whereas its southern counterpart, *Spisula*

ravenelli is not fished extensively. Sea scallops are caught only north of the Cape and calico scallops only south of it. However, a large sea scallop harvesting industry exists off Cape Canaveral, Florida at the lower limit of the South Atlantic Bight. Bay scallops, consisting of two species covering the length of the U.S. East Coast, are harvested in both areas.

The fishing industry, commercial and recreational, in the South Atlantic states is a major economic force. In Florida, for instance, about 12,350 commercial fishermen harvest an annual catch valued in excess of $40,000,000. Sport fishing generates an estimated $500,000,000 for Florida's economy, although the level of economic importance is less in the other states of this region (19,p.145).

Many migrating estuarine dependent species are primarily oceanic, but are still critically dependent on the shallow waters for their nursery areas. These fishes--flounder, bluefish, menhaden, king whiting--spawn in the open sea along the continental shelf. Their larval young, after hatching, drift and swim through the inlets and find refuge and food in the shallow waters and marshes. If the species is to survive, the juvenile fish must have an estuarine nursery area.

Some migratory fish spawn in the waters of the estuary. Their young seek refuge in the shallowest waters after hatching, finding protection and abundant food in the rich estuarine zone. Fish in this group include weakfish, drum, and shad (38).

A short synopsis of the major sport and commercial fish species of both OCS areas derived from a number of sources is given below (1,23,37):

- Menhaden (Brevoortia tyrannus) Occur from New England to Florida in shallow offshore waters. They spawn in the ocean over the continental shelf; young spend several months in estuaries in spring and summer.

- Scup (Stenotomus chrysops) Occur from New England to North Carolina - inshore in the summer and along the edge of the continental shelf in winter, between Delaware Bay and Cape Hatteras.

- Summer flounder (Paralichthys dentatus) From Maine to South Carolina. Spring to fall occurs in nearshore areas; winter to spring along the entire continental shelf edge. Is important for sport and commercial harvest.

- Herrings (Alosa spp.) Occur from Newfoundland to South Carolina. Move offshore in winter but spawn in rivers in early spring. Are caught both offshore and in the estuaries.

- Silver hake (Merluccius bilinearis) Occurs along entire Atlantic coast; principal fishing grounds are off Long Island and New Jersey but are fished in both Mid and South Atlantic.

- Winter flounder (Pseudopleuronectes americanus) Occur in both OCS regions but, in the south, occur mostly north of Cape Hatteras. Juveniles make extensive use of marshes. Adults are caught offshore by trawls.

- Black sea bass (Centropristes striatas) Occur in both OCS areas, principally offshore. Major winter fishery is at 20 to 70 fathoms off North Carolina and Virginia while summer fishery is coastal and occurs from central New Jersey north to Canada.

- Striped bass (Morone saxatilis) Range is from St. Lawrence River to Lousiana. Center of abundance lies between Cape Cod and Cape Hatteras. Spring to fall populations occur inshore and are important to sport fishing, while winter to spring populations occur offshore along the continental shelf edge and are caught commercially.

- American shad (Alosa sapidissima) Range is from Canada to Florida; center of abundance is from North Carolina to Connecticut - is of importance to sport and commercial fisheries. Spawns in rivers; spends most of its life at sea.

- Bluefish (Pomatomus saltatrix) Range is from New England to Texas and is caught along entire Atlantic coast. North Carolina Sounds are a major commercial area. Distribution in both OCS areas is coastal and offshore. Bluefish migrate in schools from Florida in mid-winter, appearing off the Carolinas in March and off New York in April and May. Spawning occurs inshore.

- Atlantic mackerel (Scomber scombrus) Occur from the St. Lawrence to Cape Hatteras, especially north of Delaware. Depth range is from the surface (near the coast in late spring) to the continental shelf edge bottom (in the winter). They are a major commercial species for the Mid Atlantic OCS area.

- Weakfish (Cynoscion regalis) Occurs from Gulf of Mexico to Massachusetts Bay and is mainly a coastal fish. It is a major sport fish in both OCS areas.

- Swordfish (Xiphias gladius) Occurs in all oceanic areas - not coastally dependent. Is common over the continental shelf of both OCS areas, but more abundant north of New Jersey.

- White marlin (Tetrapturus albidus) Oceanic in Atlantic Ocean - common south of New Jersey especially in summer. Occurs along continental shelf edge and beyond. Major sport fishing off Maryland and Delaware.

- Blue marlin (Makaira nigricans) Oceanic in distribution; primarily beyond continental shelf edge. Major sport fishing centers at North Carolina and South Atlantic OCS area.

5.1 SPILLS AND LEAKS

The Santa Barbara blow-out and oil spill in 1969 produced such a public outcry that offshore leasing outside the Gulf of Mexico ceased while the government reevaluated its policies regarding stiffer regulations and stricter enforcement. Environmentalists conclude that oil spills are inevitable, no matter how strict the safeguards may be. Potential damage to marine life and coastal-dependent economies warrant cautious leasing practices (5,p.2).

Exploratory drilling is one of the most hazardous steps in the development of offshore energy resources, due to the possibility of a blowout (21,p.58). A heavy fluid called "drilling mud" is circulated in the drill hole to counteract the rapid change in geologic structure pressure or the possible sudden flow of oil or gas. The blowout risk is proportional to hole depth and formation pressures. There is no geologic reason to believe that high formation pressures would be encountered in offshore Georgia (17,p.180), or in the Baltimore Canyon area.

Spill potential exists in tanker groundings, transshipment accidents, pipeline ruptures, production equipment failure, human error, and other minor sources of spills and leaks. The chances for major casualties or

accidents are intensified during severe storms which are more common to the South Atlantic region than the Mid Atlantic (22).

With so many possible spill factors, it is difficult to predict the volume of potential oil spillage expected from Atlantic OCS operations. One frequently quoted estimate is that used by the Bureau of Land Management, which estimates that approximately 0.011% of the overall (2.36 billion barrels) OCS production of oil and condensate in the Gulf of Mexico from 1964 to 1972 was spilled. However, the amount of oil introduced into the oceans by offshore production is quite small in relation to other sources.

"The following assumptions concerning oil spills can be made:

- Overall, offshore production is a relatively minor cause of general oil pollution.

- However, major oil spills related to offshore production can and do occur.

- These spills are characterized by "catastrophic" events of major proportions (including those attributable to natural events like storms), and by chronic, smaller spills.

- Location, strict regulation, and adherance to regulations can reduce the potential for catastrophic spills, but the chance for error (and thus, major spills) can never be entirely eliminated." (13,p.32)

Biological effects of oil pollution in the Atlantic OCS regions fall into four categories:

a. Long-term offshore effects due to chronic, low-level oil emissions.

b. Short-term offshore effects from a massive accidental spill.

c. Long-term nearshore or onshore effects due to chronic oil pollution from pipeline leaks, transfer operations, and ship support bases.

d. Short-term nearshore or onshore effects due to beaching of a massive oil spill.

Studies undertaken by BLM predict a variety of likely oil spill trajectories if a spill were to occur in the OCS Lease Sale No. 40 area. Spills would move generally southwest and likely make contact with beaches in Delaware, Maryland, or further south and would generally require about two weeks to do so. It must be recalled that the areas which will be subjected to exploratory drilling are located from 47 to 92 miles off the coasts of New Jersey and Delaware and thus minimize onshore/nearshore impacts due to distance from shore. A complete statistical analysis of the likelihood of spills contacting the shore cannot be given here but is presented in the BLM Final EIS for Lease Sale No. 40 (1,pp.56-94). However, the following generalizations may be stated:

a. the probability that a major spill (if one occurs) will come ashore for the entire project area is 10%.

b. the probability that a major spill will impact one of the ten natural environmental resource categories is shown below (includes consideration of seasonal vulnerability): (1,p.88)

Group	Probability (%)
1. Endangered Birds	1.5
2. Migratory Waterbirds	4.0
3. Shellfisheries	1.0
4. Coastal Finfish	7.0
5. Estuarine Finfish	1.0
6. Wetlands	3.0
7. Wildlife Refuges and Management Areas	6.0
8. Beaches with High-Intensity Use	2.0
9. Parks and Recreation Areas	5.0
10. Mid-Atlantic Bight Dumpsites	12.0

The resource characteristics of the Mid Atlantic onshore and offshore environment were categorized into ten groups in order to evaluate the potential impacts if a spill did reach a <u>critical natural environment</u>. Among

these ten resource groups and their seasonal occurrence were the following eight of particular relevance (Nos. 9 & 10, parks and dumpsites, not discussed):

1. Endangered birds, such as the American peragrine falcon, Southern bald eagle, osprey (all seasons), which would be impacted by oiling during feeding activities.

2. Migratory waterbirds, wildlife management areas, refuges, and concentrations of geese and ducks occur along all the shores and marshes of the Mid Atlantic states (winter, spring, fall); adverse impacts to waterfowl would be immediate if a spill entered such an environment.

3. Shellfish: areas along the shore and in the major bay mouths contain surf clams, bay scallops, northern hard clams, and oysters (all seasons).

4. Coastal finfish: A strip about 25 miles wide along the entire coast line was identified as critical habitat for egg and larval stages of scup, porgy, and menhaden (summer and fall). In addition, the fisheries for bluefish, Atlantic mackerel, butterfish, red hake, yellow-tail flounder, and fluke flounder could be seriously impacted by an oil spill (all seasons); in both nearshore and offshore areas.

5. Estuarine finfish: The Mid Atlantic area contains key estuarine habitat for weakfish, sea trout, whiting, and striped bass (spring, summer, and fall).

6. Wetlands: Large tracts of wetlands lie shoreward of the barrier islands along all of these coastal states and within Delaware and Chesapeake Bays (all seasons).

7. Wildlife Refuges and Management Areas: Many wildlife refuges and parks lie within a possible oil spill impact zone, such as: Dennis Creek Wildlife Management Area, Bombay Hook National Wildlife Refuge, Assateague Island National Seashore, Island Beach State Park, Cape Henlopen State Park (all seasons).

8. Beaches with high-intensity use: Sandy Hook, Barnegat, Atlantic City, Cape May County, New Jersey area beaches; Rehoboth Beach, Delaware area beaches; Ocean City, Maryland area beaches; Virginia Beach, Virginia area beaches (all seasons).

Nearshore spill trajectories were analyzed by M.I.T. (39) for both Mid- and South Atlantic OCS areas. The reader is referred to this source document for a complete description of likely trajectories under various conditions. However, Figures 6 and 7 show the types of analyses which were completed for

Delaware Bay and Charleston Harbor, the two most likely centers of OCS support for each region. The following discuss these trajectories:

Delaware Bay

Figure 6 shows the map of Delaware Bay used by the computer in the nearshore spill analyses. The shoreline was broken down into 51 subareas. Two spill sites were studied:

1) One in the upper central bay between Milford Neck and East Point (shown in Figure 6);

2) And the other in the bay entrance midway between Cape Henlopen and Cape May (not shown).

The wind data used were those from Wilmington, Delaware, for the period 1963 through 1972. In winter, the most likely areas are to the east and southeast with very low probability attached to the north and most of the western shores. Spring exhibits a more diffusive pattern, but once again certain portions of the western shore are low-probability areas. In summer the lower bay is almost untouched, all the impact areas being confined to a band in the upper bay area. Autumn is rather similar to spring. In all seasons Egg Island Point is a very high-probability impact area with probability ranging from 29% in winter to 51% in summer.

It would seem that analyses such as these could be profitably used in the design and deployment of spill containment and collection systems.

Charleston Harbor

Figure 7 shows the map of Charleston Harbor used by the computer. Wind data were based on Charleston, South Carolina, weather records, 1963 to 1972. The shoreline was broken down into some 51 areas. A single spill site was studied, located in the center of the main harbor. With minor exceptions, there is very little seasonal dependence as far as the initial impact areas are concerned. They are spread rather evenly over the main part of the harbor.

Charleston Harbor is much smaller than the other two areas studied, and 60% of the spills are ashore within seven or eight hours. There is little seasonal dependence in the times to shore. Since the distances and times to shore are so small, the results are dominated by the tidal currents and seasonal wind rose properties.

Figure 6. Delaware Bay impact areas for spills occurring at the upper bay site. Season - spring (Source: Reference 39).

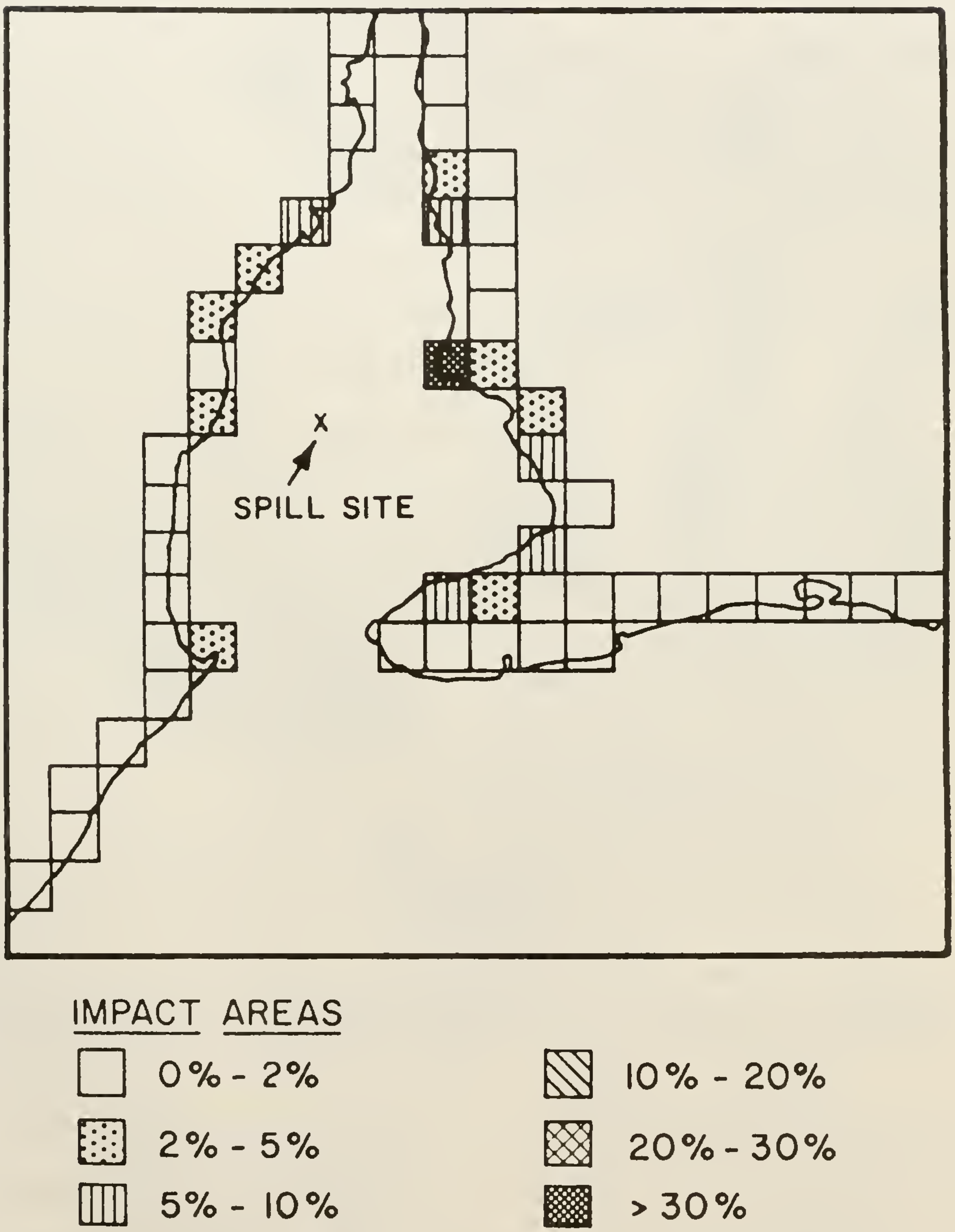
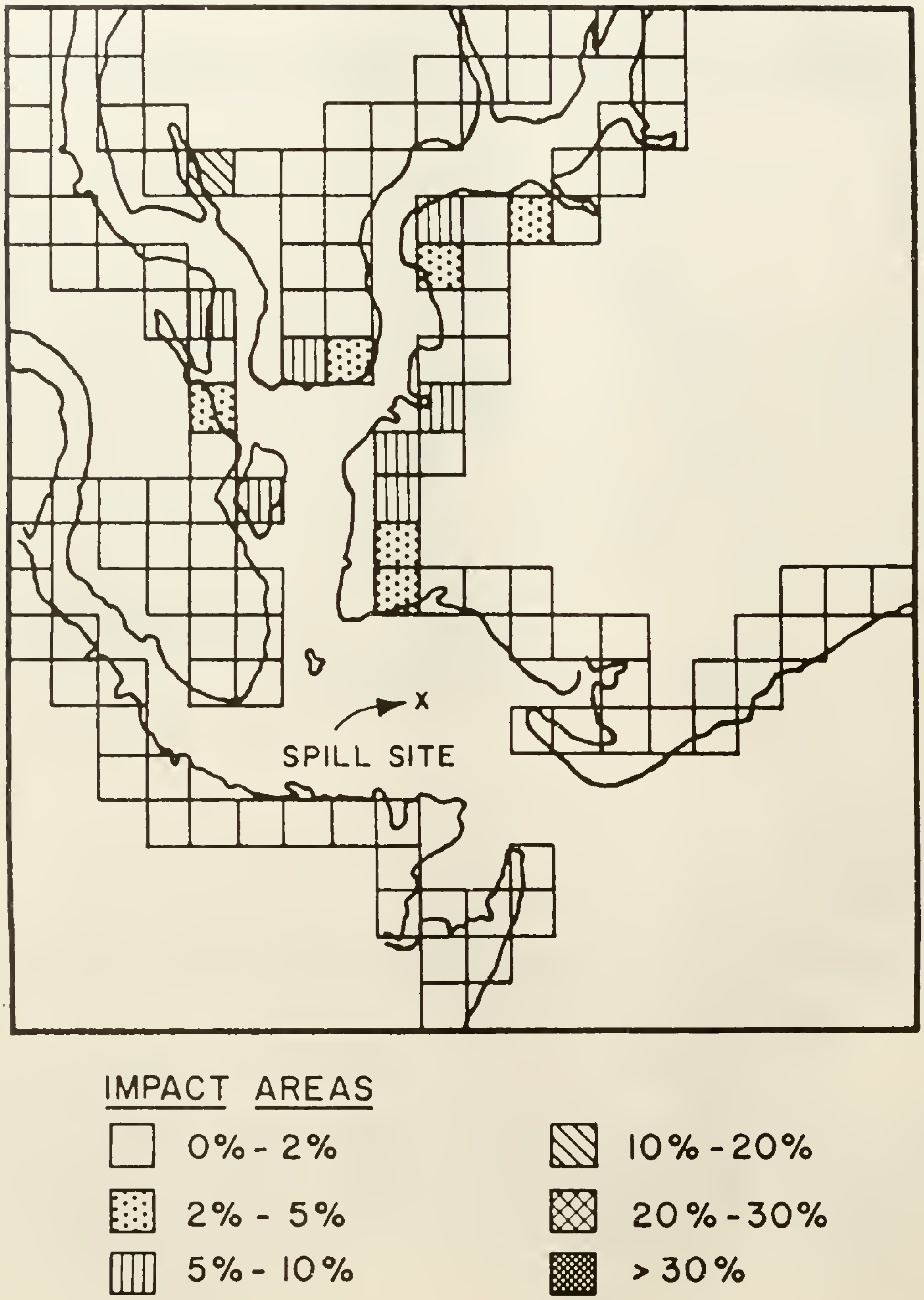


Figure 7. Charleston Harbor impact areas for spills at central harbor site. Season - spring (Source: Reference 39).



> Areas in which more than 20% of the spills come ashore in winds over 12 knots are localized in the Charleston-Hog Island areas once again with little seasonal variation. However, as might be expected given the smaller distances, the initial impact areas are more sensitive to initial spill size. The smaller the area, the more important the spill spread is relative to spill transport.

The foregoing analyses are meant to be exemplary in nature. The choice of sample harbors does not imply advocating any of these locations. Rather, the analyses undertaken are intended to be models of the sort of work which could be done in any oil handling area under consideration.

The possibility that oil spills from the offshore production areas would affect the natural environment is summarized by BLM (1,p.92-94):

> In summary, it seems reasonable to conclude that although there is a 39% probability that <u>at least one</u> oil spill greater than 1,000 barrels will reach shore during the anticipated 25-year production life of this area, any effects on the nearshore or onshore environment would be due to the residual oil, and not the more toxic lighter fractions which would have already disappeared into the offshore environment. In the worst case, it took four days for one of the 2,800 hypothetical spills to reach shore, however, the lighter, more toxic fractions of crude oil boil off (evaporate) during the first few hours of an oil spill leaving the heavier, less toxic hydrocarbons remaining.
>
> It also seems reasonable to conclude that, due to the weathering process and the constant reduction in the amount of remaining residual hydrocarbons combined with the constantly improving effectiveness of oil spill containment and recovery equipment, the impacts associated with an oil spill reaching a shoreline would be relatively small. It is possible that impacts could occur in the form of well-weathered oil reaching shore in beach and wetlands areas. In addition, that well-weathered oil that enters the water column and reaches the ocean floor could impact various shellfish and finfish habitat areas.

Adverse impacts from low-volume, chronic oil leaks from pipelines, gas/oil separation plants, pumping stations, and ship support facilities may prove to be significant on a local level although precise statistics as to what levels of oil leaks to expect are not available. Data for oil pipeline

leaks are lumped together with breaks in pipelines caused by commercial fishing pier damages, the dragging of anchors across pipelines, and structural failures, as well as with chronic leaks due to mechanical problems or material failures. Thus, it is not possible to directly assess the impacts of oil leaks on natural resources until the level of OCS activity is known, production platforms placed, and pipelines and gas plants located.

It is important to be aware of the decreased likelihood of major spills if oil is brought ashore via pipeline rather than by tanker, as highlighted in the conclusions of the M.I.T. study - Analysis of Oil Spill Statistics (39,part 2), which are reproduced here (the purpose of the M.I.T. analysis was to utilize past spill experience to estimate the likelihood of spills along the Atlantic continental shelf):

1. It has been determined that the size range of an individual oil spill is extremely large--eight orders of magnitude. The great majority of all spills are at the lower end of this range. But most of the oil is spilled in a few very large spills.

2. For all the reasons given in 1, point estimates of spillage and spillage rates are practically meaningless. Further, from the biological points of view, the frequency and magnitude of individual spills is at least as important as total spillage. Therefore, an estimate of the probability densities of the number of spills of a given category which will occur from a given hypothetical development and the probability density of the size of these spills are both of particular significance. These estimates are broken into six categories and result from the application of an assumed spill incidence.

	>42,000 gallons	<42,000 gallons
Tanker/Barge		
Platform		
Offshore Pipeline		

3. With respect to tanker spills above 42,000 gallons, the results indicate that for a small find (500 MM bbls in place) likelihood of no tanker spills is about .7, the likelihood of one such spill is about .25, and it is quite unlikely there would be more than one spill. However, for a large find (10,000 MM bbls in place) there will with high probability be somewhere between 4 and 10 spills, with the probability rather equally spread over these possibilities. The estimated size of these spills is spread over three orders of magnitude, with a mean of two million gallons. [MM bbls = millions of barrels.--Ed.]

4. With respect to tanker spills below 42,000 gallons, the number of spills is much larger; in the hundreds for the small find and thousands for the large find. However, most of these spills are quite small. The mean size is 318 gallons and it is quite likely that an individual spill will be smaller than the mean. For an offshore mono-buoy platform (SBM) total volume spilled will almost certainly be lower for an SBM installation as opposed to an equivalent shoreside terminal. [Probably due to a larger number of transshipment operations necessary to get large tankers into a shore facility.--Ed.]

5. With respect to platform spills over 42,000 gallons, the analysis indicates that for a small find, there is a .75 probability of no such spill, a .2 chance of one such spill, and it is quite unlikely that we will experience two or more such spills. For a large find, with high probability we will experience between one and seven such spills with the probability rather equally spread over the possibilities. The size of these spills is spread over two orders of magnitude, with a mean of about one million gallons and a standard deviation of 1.8 million gallons. The probability that such a spill will be less than 100,000 gallons is about .2. The probability that it will be greater than 5 million gallons is .05.

6. With respect to offshore pipeline spills over 42,000 gallons, the probability that we will have no large pipeline spills from a small find landed by pipeline is .75. The probability we will have one spill is about .2 and it is rather unlikely we will have more than one such spill. For a large find landed by pipeline, with high probability we will have somewhere between 1 and 9 large pipeline spills, with the probability rather equally spread over these possibilities. The size of these spills is dispersed over an extremely large range. The size of these spills is not easily determined. The mean is 1.9 million gallons; the standard deviation is 3.9 million gallons.

7. With respect to offshore production spills less than 42,000, the total number of both small platform and small pipeline spills will be in the hundreds for a small find and in the thousands for a large find. According to the EPA data, approximately 90% of these spills will emanate from the platforms.

Almost all these spills will be quite small. The mean of these spills is about 100 gallons, and it is quite likely that an individual spill will be less than the mean.

8. With respect to total volume spilled over the field life, the mean for the small find is about 900,000 gallons for the small find landed by pipeline and 1,100,000 gallons for the small find landed by tanker. The variance is quite large and there is a substantial probability in both cases there will be no large spills at all. The standard deviation for the small find landed by pipeline is over 2.65 million gallons; if landed by tanker, 2.45 million gallons. Thus, there is a slightly higher chance of both small total spillage and very large total spillage with the pipeline rather than the tanker, reflecting our greater uncertainty about pipelines.

   For a large find, the mean of the total spillage is 15 million gallons for pipeline transport and 19 million gallons for tanker. The ratio of the standard deviation to the mean is not quite so large for the large find as the small find, as the law of large numbers is beginning to work, although weakly. The standard deviation of the total spillage assuming tanker transport for the large find is 10.3 million gallons, and for the pipeline option is 11.5 million gallons.

9. All the above estimates of probabilities can reasonably be regarded as moderately pessimistic. They assume no improvement in technology or operations over the recent past.

10. Finally, it is extremely important to realize that the above estimates of probabilities do not represent the net effect of OCS development. The net effect will depend on what one assumes about the oil which would be landed in the absence of the development. For example, if one assumes the same amount of crude will be landed on the East Coast with or without a development, then according to the analysis there is a substantial probability that there will be as many large spills without the find as with the find.

5.2 COASTAL ECOSYSTEM IMPACTS

Coastal ecosystems which may be affected by OCS activities include:

a. the offshore, oceanic region;

b. the nearshore zone;

c. major estuaries and bays;

d. salt marshes and wetlands.

Possible adverse effects of OCS oil development on coastal ecosystems fall under the following categories:

a. Oil spills from platforms and transport systems;

b. Discharge of drilling mud and formation waters;

c. Operation of the production platforms;

d. Pipeline burials;

e. Industrial discharges;

f. Ship traffic and ocean disposal.

The living resources of the offshore OCS region which might be affected include:

a. Fisheries (commercial and sport fish) --

-pelagic and bottom fish,
-larval and egg stages;

b. Benthic communities;

c. Zooplankton populations;

d. Phytoplankton population;

e. Marine mammals;

f. Water quality.

As indicated in the introduction to this section, the regional variability of impacts will be minor, that is, an oil spill offshore of New Jersey will adversely affect the benthic community as readily as an oil spill off North Carolina. The difference lies in the organisms affected; in the former it would be primarily the surf clam, and in the latter, the calico scallop.

Impact of offshore activities on entire coastal fisheries will likely not be dramatic during development and production of the offshore fields. However, significant localized effects may occur. The impact on fish will vary according to the size of the spill, time of the year (large numbers of

migratory fish may be in the area), and the chemical make-up of the crude oil. Though fish can, and may, avoid contaminated areas, many will likely not be able to do so. Also, low dilutions of petroleum hydrocarbons can have behavioral and physiological effects and can cause tainting of the fish flesh. This last effect could render certain portions of a catch inedible for a certain period of time.

Nearshore area fish populations can similarly be affected by oil spills and leaks. Since a great amount of spawning activity occurs in these shallow waters, the likelihood of increased damage to egg and larval stages of fish populations does exist. Though unlikely, a massive coastal spill could thus drastically reduce a regional fish population if such a spill occurred during the height of the spawning season. Anadromous species such as striped bass, shad, and herring would be especially vulnerable during their movements into and out of estuaries if a spill occurred in the nearshore zone. Spills during the spawning season could prevent eggs from hatching or fry from developing.

Discharge of formation waters is generally a by-product of oil production. In those instances where such waters are not discharged, they are re-injected to the substrate. Formation waters are generally brines with salinities many times greater than that of sea waters, containing high concentrations of mineral salts, petroleum hydrocarbons (up to 30ppm), and some traces of heavy metals. Due to lack of actual drilling experience in the Mid- and South Atlantic lease area, the precise component concentrations of formation waters cannot be known at this time. Based on USGS estimates of 90,000 to 320,000 barrels of oil per day at peak production, we can expect a maximum of about 300,000 barrels per day of formation waters. These waters are treated to reduce their oil content to 30 ppm before discharge.

Discharge of formation waters could produce local water quality changes which would probably be avoided by fish. The extent of the mixing zone would also be a function of tides, winds, and wave action. Rapid mixing of such waters near a production platform is anticipated. The effect of water soluble petroleum aromatic compounds not removed in the separation process might be harmful at sublethal levels (1,p.152). In general, however, formation water discharge effects will be very localized.

Fish populations in coastal areas, as delineated in the introduction to this section, could also be adversely impacted by the discharge of drill cuttings and drilling mud. The latter material commonly contains high concentrations of barium and chromium, and consists otherwise of clays and small amounts of organic and inorganic chemicals. Estimates of drilling muds which may be discharged into the Mid Atlantic OCS area range from 55,540 to 458,464 tons (1,p.99). Damage to fish populations, if it occurs, could come from localized effects of: increased turbidity, smothering of bottom-feeding habitat, and possible uptake of heavy metals (specifically barium from the drilling mud) and some petroleum hydrocarbons.

Commercial and sport fisheries can further be adversely affected by removal of the sea floor and pelagic areas from fishing use due to platforms and pipelines. Especially vulnerable would be shellfish such as scallops, crabs, shrimp, and finfish such as flounder and whiting.

In the Mid Atlantic OCS region it is estimated that a maximum of 810 to 3,240 acres could be removed from commercial fishing at any one time during development. For continuous production, a maximum of 50 platforms, at five acres each would be required. This would mean a minimum of 250 acres of actual land lost, but to which a buffer zone must be added, plus areas lost

to pipeline corridors.

Trawling in both OCS regions occurs to depths of 120 to 555 feet in the Mid Atlantic; thus oil development will have some impact on commercial fishing. Species most immediately impacted would be crabs, lobster, scallops, mackerel and flounder. Further problems may arise in that the platforms present navigational obstructions. Also, offshore oil development will increase ship traffic in an already heavily used area.

Pipelines may pose a problem to bottom trawling techniques and cause fishing gear to snag. However, such pipelines will have to be buried in water depths less than 200 feet and may be laid in corridors to minimize possible problems. Also, pipeline locations will be marked on maps and announced in the Notice to Mariners.

The overall impact to sport fishing should be minor. In the Mid Atlantic OCS lease area sport fishing is not commonly carried out as far as 40 to 90 miles offshore except for marlin, swordfish and tuna fishing in parts of the Baltimore Canyon Trough and in areas of offshore North Carolina and Florida. There is an extensive offshore charter boat activity on "live bottom" areas in the South Atlantic which could be adversely affected. The sport fishing industry appears not to be affected by offshore platforms in the Mid Atlantic. However, because the width of the continental shelf is much narrower in the South Atlantic, offshore activities may be closer to nearshore sport fisheries and might have more impact. Long duration effects of minor impact are expected for nearshore sport fishing from burial of pipelines or use of support vessels.

Benthic communities, which are important as a commercial resource (clams, scallops, oysters, shrimp, crabs) and as a food source for important finfish and shellfish species, will suffer significant adverse effects but probably on a localized scale. Activities of greatest potential impact will be:

a. construction of pipeline corridors and burial of pipes;

b. emplacement of platforms;

c. deposition of drilling wastes near the platforms.

As many as 3,000 acres of benthic habitat could be affected by platform construction and operation, while pipelines will require a several-hundred-foot swath from the platform to shore. Drilling wastes may impact benthos by forming mounds near platforms several hundred feet in diameter and several feet deep, causing sessile organisms to be lost. Increased turbidities associated with pipeline burial and drilling waste disposal will further impact the benthos as well as all other local marine communities. Effects of small amounts of oil, hydrocarbons and heavy metals in the drilling wastes on the benthos has not been well established and may be negligible.

Recolonization of disturbed sediments will take place rather quickly (probably between 3-6 months) along pipelines and other areas which are not regularly disturbed by such activities as discharge of drilling cuttings.

Impact on zooplankton and phytoplankton communities may stem from oil spills, discharge of drilling muds and formation waters, and from turbidities caused by pipeline burial activity. The offshore plankton communities are less concentrated than those in the bays and nearshore areas (43 ,p.279). Thus, a spill in the production area would likely cause less damage than one in the estuarine zone. Turbidities would be caused by several factors previously mentioned, but especially by drilling

mud which is discharged along with drill cuttings. The mud is mostly composed of fine clays which readily form long-lasting turbid suspensions. If the projected maximum of offshore production platforms (50 for the Mid Atlantic) is realized, then the combined operations could possibly cause a diminution in regional planktonic populations. The locations of the production platforms cannot yet be determined, but it is estimated that one platform will be required for every four lease blocks (over 20,000 acres)(13,p.23).

Phytoplankton communities form the base of the marine food chain in that they are able to photosynthesize, fix carbon, and produce complex molecules. Such organisms--algae and diatoms--are eaten either by the zooplankton or by planktonivorous fish such as shad. Indications are that, for the Atlantic OCS region, planktonic species are generally evenly distributed although the population biomasses may exhibit extreme "patchiness" (1,p.116). Phytoplankton are found in the euphotic zone, which may extend to the 200 foot depth off the Atlantic Coast. Thus a spill or extensive amount of turbidity may have no effect one month but cause massive problems at a different time, depending on the concentration of plankton.

Of major consideration in the plankton are pelagic larvae of fish and shellfish. The distribution and concentration of the ichthyoplankton varies with the seasons. Such planktonic larvae may suffer mortalities on a seasonal basis by events such as an oil spill.

> Other commercially important species that may be impacted include the planktonic larvae of the surf clam, soft-shelled crab, sea scallop, American lobster, lue crab, rock crab, Jonah crab, ocean quahog, southern quahog, northern quahog, and American oyster (1,p.116).

Marine mammals may be affected by OCS development in the Atlantic, but probably only to a very slight degree. There are no known concentrations

of marine mammals in the study area. There are also no known breeding sites for pinnipeds (seals and walruses) on the Atlantic coast. Only occasional strays of harbor and hooded seals have been reported in the area. The harbor seal is a coastal species, while the hooded seal is a pelagic (offshore) species. Thus, due to their habitat, harbor seals could be impacted by a nearshore spill, while hooded seals would be affected by spills in the producing lease area.

The direct effects of oiling on marine mammals could include the matting of pelage, irritation of skin and eyes, indigestion-causing internal disorders, and possible clogging or inflammation of respiratory passages. Again, the low population numbers of pinnipeds in the region indicate that few such occurences will result (1,p.153).

The impact of OCS activities on cetaceans is given by the BLM as (1,p.154-156):

> Thirteen species of cetaceans, including three endangered species (right, fin and humpback whales) have been sighted in recent times (the last 50 years) in the Mid Atlantic. There is, however, little information on the life histories of the cetaceans in the area. There is little factual information on the effects of oil on cetaceans. No record is reported of cetacean deaths due to the direct effects of oil pollution. There were no reported sightings of dead whales following the Santa Barbara oil spills.
>
> Because of the endangered species status of some cetaceans, and their apparent limited distribution or occurrence in the Mid Atlantic region, any impact to individual cetaceans could have consequences on specific populations or distribution. Because of the apparent paucity of cetaceans in the Mid Atlantic, the probability of an individual being in a specific area at the time of an oil spill appears low. Therefore, while potential for an impact exists, cetacean species and populations are unlikely to be impacted as a result of the proposed Mid Atlantic sale.

Impacts of offshore oil and gas operations on <u>water quality</u> will depend on the ultimate level of production which is maintained in the OCS lease areas.

For the Mid Atlantic, production levels are estimated as 90,000 to 740,000 barrels of oil per day peak production. Thus, a scenario of 740,000 barrels per day would represent the maximum level of impact on water quality.

Changes in local water quality may be caused by:

a. Discharge of formation waters and drill cuttings;

b. Discharge of drilling muds;

c. Resuspension of bottom sediments;

d. Oil spills, blowouts and pipeline ruptures.

The most severe degradation of the existing offshore water quality can be attributed to oil spills and discharges of formation waters and drilling muds. Deposition of drill cuttings, consisting of substrate components such as sand, ground rock, and mud, should not pose any long-term water quality changes. It is assumed that turbidities caused by such disposal, and by pipeline burials will be short-lived and will settle out within several hundred feet of the site of activity. Pollutants which could be reintroduced into the water column, such as heavy metals, are generally associated with particulate matter and settle out as turbidity is reduced. The bio-accumulation and effect of low concentrations of metals in the marine ecosystem are poorly documented.

The effects of oil spills or blowouts on water quality would be to increase the level of petroleum hydrocarbons and trace metals in surface and near surface waters. Deeper waters would be contaminated by oil carried down with suspended solids and incorporated into the sediments. The effects of oil and hydrocarbons in the water column on plankton, fish and marine mammals have been delineated earlier.

Formation waters from the oil fields can be expected to contain low levels of hydrocarbons, dissolved mineral salts, and traces of heavy metals. A common rule of thumb of production of formation waters is that about one barrel of water is discharged for each barrel of oil produced. Although legal requirements call for removal of oil to a 30 ppm level, these waters will still contain high concentrations of salts and metals. Most of the salts consist of sodium and calcium chlorides and some sulfates and bromates. Since dilution in the open ocean would be immediate, any increases in salinity or minerals would not be detectable beyond a few hundred feet of the discharge point.

More significant water quality degradation would occur from used drilling mud discharged into the sea. Drilling muds consist of clays, barite, and small amounts of organic and inorganic chemicals. The composition of the mud is varied according to the specific drilling substrate requirements and each drilling operation or company. Drilling mud from exploratory wells is continuously sampled for fossils and paleontological evidence indicating likely oil-bearing formations. For this reason it cannot be recycled and is discharged at the drill site. Production wells do allow for re-use of the mud; about 10% is lost due to contact with drill cuttings, however. Discharge of drilling muds is regulated by the Environmental Protection Agency, which may limit such discharges if heavy metal levels approach toxic levels. When drilling mud is added to sea water, the fine clays remain in suspension for a considerable time. Associated with the clays are the metals and petroleum hydrocarbons. Although some of these polluting substances will go into solution in the water column, the greatest portion will settle out with the clays a few hundred (or thousand) yards from the platform.

5.3 SHORELAND HABITATS

Shoreland habitats for this discussion include the portions of the intertidal zone above mean low tide--brackish water marshes, fresh water wetlands, and all terrestrial habitats such as beaches, dunes, old fields, and woodlands.

The Mid Atlantic region (New York through Virginia) estuarine and nearshore environments are dominated by large estuaries, barrier islands, and coastal marshes which form in the quiet estuarine and barrier island lagoon environments (23). All of these areas, as well as the barrier beaches and sea islands of the South Atlantic region, are of importance to regional wildlife, waterfowl, and marine species. Impacts of these areas must be considered adverse and significant. The most conspicuous wildlife in the Atlantic coastal region are the numerous migratory waterfowl and shorebirds. A major segment of the Atlantic Flyway bird population passes through this region each spring and fall, and many overwinter. More than 75 percent of the Flyway's Canada goose population winters on or near tidewater, from Kent County, Maryland to Hyde County in North Carolina. The marshes and grain fields of the Delmarva Peninsula are particularly attractive to Canada geese and to grain-feeding black ducks and mallards. About half of the whistling swans in North America winter on the estuaries of Chesapeake Bay and Currituck Sound. The total wintering population of waterfowl exceeds 3,000,000 birds. The region is the center for waterfowl hunting in the eastern United States, and each year it attracts thousands of hunters.

The extensive marshes along the coast and streams of the coastal plain provide habitat for innumerable species of aquatic birds (both resident and migratory) and mammals. Additionally, the estuarine marshes are a vital link

in the food chain and life cycle of many estuarine and marine species of fish and invertebrates upon which the sport and commercial fishery is based. Several species of furbearers--e.g., the muskrat, nutria raccoon, mink--provide a substantial annual commercial harvest.

A generalized appraisal of the nearshore habitats of the Mid Atlantic region is given by the Virginia Institute of Marine Science (24,pp.13-14), of which certain sections are excerpted here:

> In New York, the western section of Long Island has a very irregular coastline, with numerous deep bays and promontories. The North Shore possesses narrow, rock or pebble beaches with high bluffs and small marshes. This contrasts with the South Shore's barrier beaches and quiet back bays. The Raritan Bay region is characterized by high bluffs and marshlands fronted by narrow beaches intersected by numerous tidal creeks. The region to the south of Raritan Bay consists of long sandy barrier islands with back bays, salt marshes, and meadows that in some areas extend several miles inland. In Delaware and Maryland there are long, low, narrow barrier beaches fronting a series of embayments with infrequent narrow inlets connecting them to the ocean. Virginia has more variation north to south going from barrier island, mainland small buffer islands, mainland and barrier beach. The barrier islands in Maryland such as at Ocean City have undergone extensive development as compared to Virginia's barrier islands which are principally privately or federally owned conservation areas.
>
> Pennsylvania's entire estuarine environment consists of a 45-mile reach of the Delaware River within the tidal influence.
>
> The Delaware River and estuary is the second largest seaport in the United States and is the site of the largest concentration of oil refineries on the east coast. Despite this, the estuary contains extensive tidal and freshwater marshes and is a very productive coastal region.
>
> The Chesapeake Bay is one of the largest estuaries in the world, with a surface area of approximately 4,400 square miles and a length of almost 200 miles. Because of the variations in salinities, the Bay supports a wide variety of fish life, is the spawning area and nursery for many ocean fishes, and is a favored habitat for many important shellfish.
>
> If considered as a whole, this region falls into the Virginian classification and acts as a transition zone between Arcadian and Carolinian regions. Oyster grounds, reefs, or "rocks" occur in abundance in the shallow bays of the coast of this region

especially from New Jersey southward.

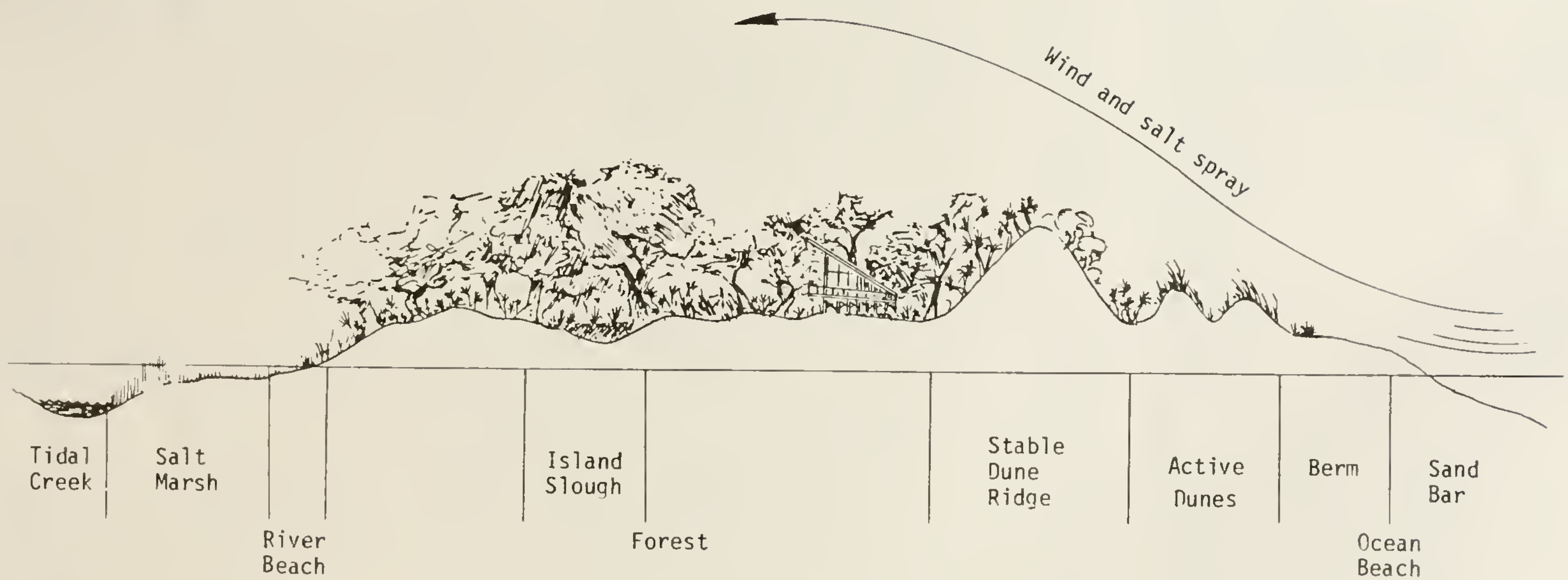
The salt marshes of this region show a subtle shift from the New England type to that more characteristic of the South Atlantic and Gulf Coastal Plain. Here, there are limited areas of smooth cordgrass (Spartina alterniflora) with saltmeadow grass (Spartina patens) occupying the largest area. There is a similar zonation pattern found on the eastern shore of Maryland. The western shore of the Chesapeake Bay with its stronger freshwater influence has Spartina alterniflora in areas covered by tides, but giant cordgrass (Spartina cynosuroides) often borders tidal streams.

The South Atlantic nearshore region consists of almost continuous expanses of barrier islands, sea islands, marshes, and estuaries. These barrier and sea islands commonly shelter productive marshes on the landward side, as shown in Figure 8. Toward the southern portion of this region, i.e., the Florida East Coast, the coastline consists of sea islands broken irregularly by inlets.

Along most of the North Carolina coast extends a series of barrier islands known as the Outer Banks. Behind the islands lie large estuaries containing small islands, and the mainland shore. The primary differences between these barrier islands as compared to those further north is the distance between the islands and the mainland. The Outer Banks lie 20-30 miles off the mainland while further north about 10 miles is the greatest distance between barrier islands and mainland (24,p.15).

The Outer Banks barrier islands are composed of two types: Those stabilized by man's efforts and the natural. The natural islands have wide beaches, up to 600 feet, and a long zone of low dunes and sparse vegetation. Overwash and the opening and closing of inlets is common for such beach islands (25,p.155). The stabilized dunes of man-altered areas are much higher, have very short, steep beaches, and are maintained primarily by heavily fertilized American beachgrass (Ammophila breviligulata)(25,p.158).

Figure 8. Cross-section of a Georgia coastal island (Source: Reference 45).



Major estuaries of the South Atlantic Region are (24,p.16):

- Pamlico River
- Pamlico Sound
- Cape Fear
- Georgia Salt Marshes
- Albemarle Sound
- Currituck Sound
- Alligator River
- Croatan Sound
- Bogue Sound
- New River
- Topsail Sound

North Carolina possesses more acres of oyster beds than all the other states in this region combined. This reflects the extensive shallow water areas behind the barrier islands and the waters are less turbid than those in Georgia.

The Pamlico River is one of the major rivers in this region. This estuary is wide and shallow with wide sandy areas along the shore.

The marshes behind the Outer Banks of North Carolina consist of either vast, pure stands of black needlerush, primarily <u>Juncus roemerianus</u> , or stands of <u>Spartina patens</u> that resemble the salt meadows of New England. The area south of Cape Lookout, North Carolina is the region for optimum development of salt marshes in the United States. These low marshes characterized by vast expanses of smooth cordgrass, <u>Spartina alterniflora</u>, form behind narrow barrier islands in areas influenced by heavy silt deposition from large rivers. There is only a small amount of open water behind the barrier islands. This region includes the famous Sea Islands of South Carolina and Georgia. The broad, level expanses of grass and soft sediment develop dendritic creeks and deep tidal channels in vast numbers that are characteristic when viewed from the air.

Oyster reefs, which are found in the brackish region from Canada to the Gulf of Mexico, generally occur in salinities between 5 to 28 ppt (23,p.6-23). Because of this physiological restriction, they are common to almost all brackish estuaries from New England to Florida, though the exact location of local reefs must be determined from state fishery agencies. In this way, the alignment of pipelines can be arranged to bypass productive oyster grounds.

<u>Impacts on nearshore and shoreland habitats</u> from OCS oil and gas developments may be similar to impacts which occurred from past activities such as

dredging, construction in marshes, oil spills from transportation sources, demographic changes, and harbor support facilities. Habitats which may be adversely affected include; marshes, oyster reefs, beaches, dune regions, fish and shellfish nursery grounds, wildlife habitat and refuges, coastal islands, and farming lands.

The digging of pipeline trenches in various habitats (near shore, wetlands, and uplands) causes considerable localized impacts. The 50 to 60 foot swath needed for construction equipment movement and burial of the pipeline is the most seriously altered. If pipeline corridors are to be used, the path of disturbance would encompass a wider area locally but would also disrupt less land on a total scale.

The following description of likely impacts on Mid and South Atlantic OCS onshore habitats is taken from BLM's Final EIS on the Lease Sale No. 40 (pp. 316-319):

> Upland vegetative communities are liable to be impacted from pipeline burials or construction of onshore facilities. Impacts upon them would primarily be their removal in the clearing process prior to construction and while dredging from the burial of pipelines. This would initiate a period of secondary succession in the immediate area affected. These areas would be relatively small but the plant succession associated with them would continue for a long time. The principal vegetative covers in the storage areas would probably be grass for the convenience of working in close proximity to storage facilities.

Other aspects of onshore facilities can impact vegetation, including maintenance activities, changes in air quality, and toxic spills. Impacts on vegetation due to pipeline and storage facility spills can occur. Herbaceous or sessile forms receive the greatest impacts due to direct toxicity or smothering while large mobile forms are not covered by oil and are less likely to be impacted (1,p.318-319). On a long-term basis the possibility of impacts would probably continue at least as long as the various facilities are in use

which would ultimately depend on the life of the proposed offshore fields and continuation of imports thereafter.

Impacts of oil spills on wetlands will vary with the extent of the spill, season, and flushing action of the tides. Also important in assessing potential damage to marsh plants are the type of oil and the plant species involved. Various studies referenced in the BLM Impact Statement reveal that marsh plants can generally survive light to moderate oiling from a single dose, but repeated dosings tend to be lethal. Also, weathered oil, which has lost the more toxic aromatic petroleum hydrocarbon fractions, is less toxic than fresh oil. Some smothering from heavy crude oil can occur in marsh habitats.

Impact of oil on marsh plant species can depend on time of year. It would probably have the greatest impact during the growing season as compared to other times. It may influence flowering, seed development, and vegetative reproduction. Annual or herbaceous species may suffer more than perennials as they cannot survive by regeneration from roots.

Additional effects of oil spills in marshes would be to reduce the faunal component of the ecosystem. Organisms may be killed by direct toxic action, smothering, starvation from loss of food supply or may be damaged physiologically from intake of oil. Edible shellfish, fish and crabs, which constitute a major interest for local sport fishing, could ingest enough petroleum hydrocarbons to taint their flesh and render them inedible for a period of time. Higher level animals in the food chain could also be adversely affected by oil spills in marshes. Among these might be; geese, ducks, hawks, gulls, wading birds, song birds, muskrats, raccoons, nutria, turtles, and amphibians. Most such effects would arise from soiling of feathers and fur,

thus preventing flight and causing loss of insulation, or from ingestion of oil during attempts to cleanse themselves.

Potential effects of OCS-related operations on the near shore environment of the South Atlantic coastal zone are presented below (including dredging, pipeline filling and onshore facility construction, super tanker operations, oil spills):(17)

Impact

Biological

1. Disruption of near shore, and estuarine habitat and ecosystems.
2. Disruption of feeding and breeding of birds, fish, reptiles and mammals in intertidal zone.
3. Decrease in primary and secondary productivity.
4. Disruption of natural drainage and water current patterns.
5. Toxic and sublethal effects on marine organisms from chronic pollution.
6. Oiling or lethal effects of spills.

Non-Biological

1. Beach damage.
2. Navigation hazard.
3. Aesthetic degradation.
4. Damage to archaeological or other cultural resources.

Significance

Biological

1. Near shore area is nursery for 60% of commercial fish.
2. Loss of shell fish beds.
3. Possible interruption of anadromous fish migration.
4. Decrease of fresh water supplies.
5. Loss of species diversity.
6. Change of aquatic environment leading to population redistribution.
7. Disruption of food web.
8. Concentration of toxic fractions through food chain.

Non-Biological

1. Loss of recreation value.
2. Hazards for small craft (fishing boats, shipping).
3. Possible erosion or siltation problem.
4. Loss of aesthetic or cultural resources.

As shown in Figures 9, 10, and 11, there are many important recreation and conservation areas that are vulnerable to oil spill damage because of their coastal locations.

5.4 FISH AND SHELLFISH

The effects of offshore oil and gas development on future fish and shellfish resources fall under several possible headings:

Figure 9. Recreation Areas of Long Island (Source: Reference 1).

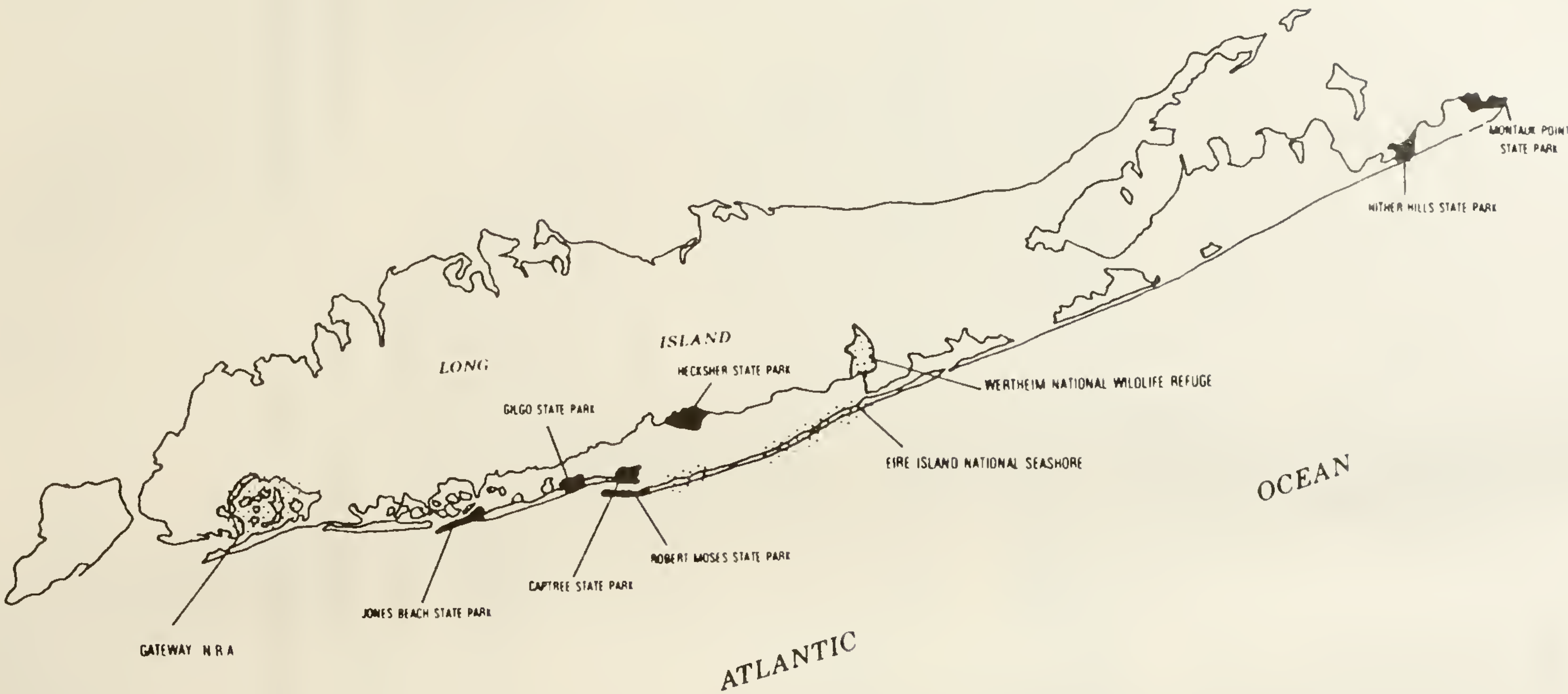


Figure 10. State and federal recreation and open space areas (Source: Reference 1).

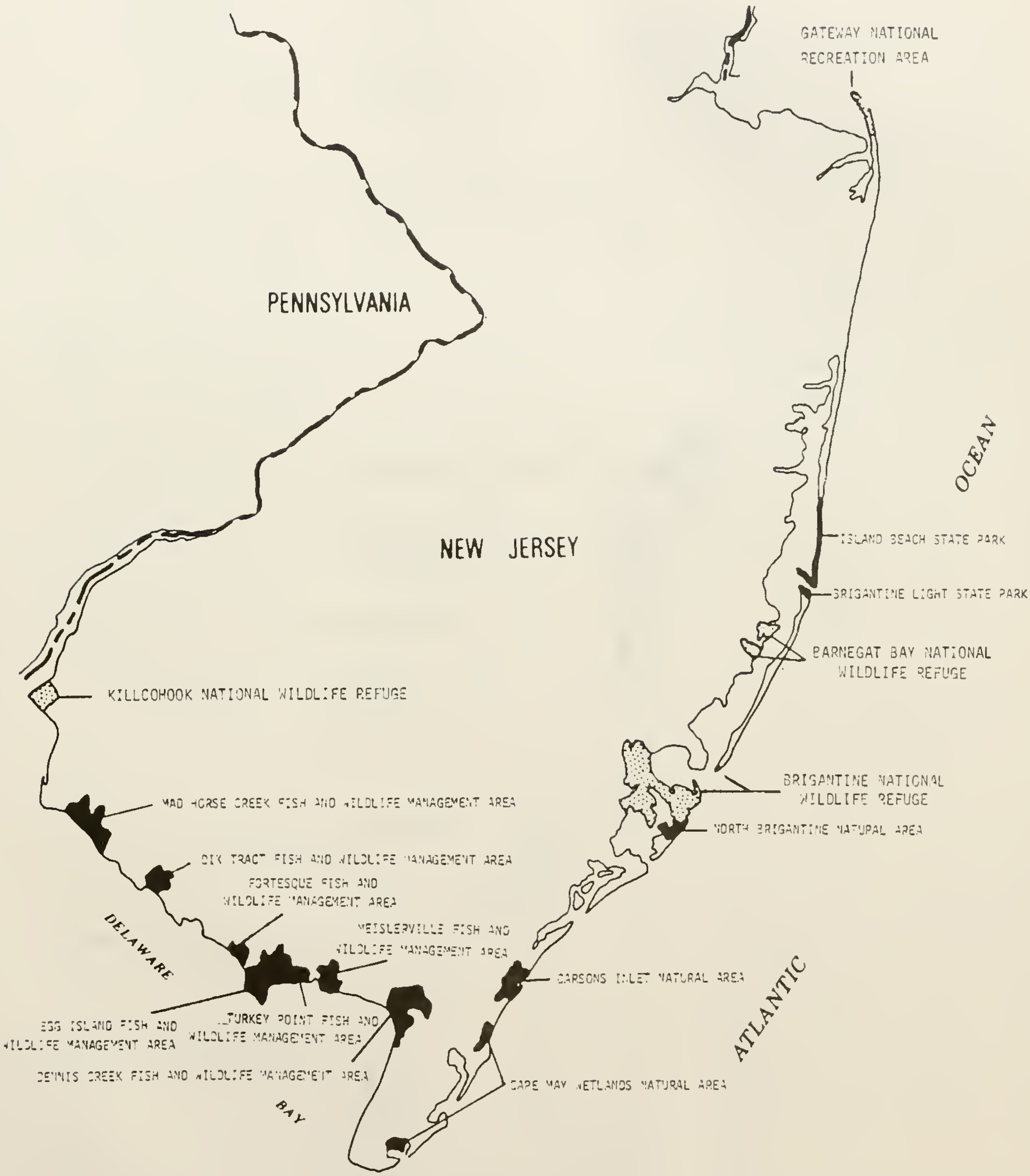
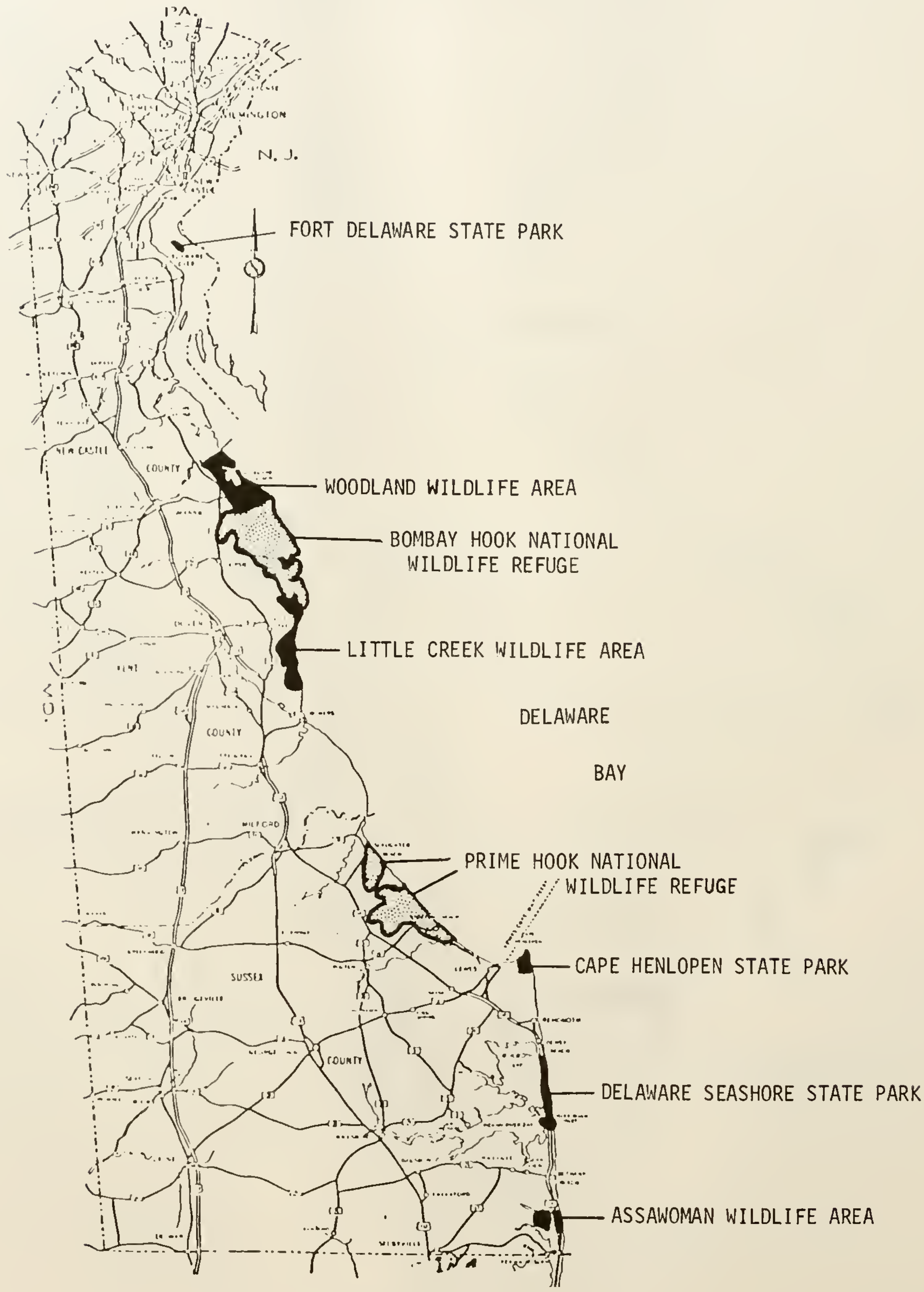


Figure 11. State of Delaware recreation and open space areas (Source: Reference 1).



1. Effects of oil spills and chronic oil contamination.

2. Effects of dredging and pipeline burial.

3. Effects of support facilities such as harbors.

4. Secondary effects of increased population, recreation use, and food supply. Demands on fisheries.

5. Effects of loss of habitat due to secondary spin-off developments.

Specific fisheries information were presented earlier in this section, thus a more generalized impact analysis is given here.

Fish and shellfish populations could be adversely affected if oil spills, continuous small leaks from pipelines or harbors, cause lethal effects on eggs and/or fry in spawning areas. This effect could occur at continuous exposure to concentrations of soluble hydrocarbons derivates in excess of 0.1 ppm (1,Vol.1,p.107). These concentrations of soluble hydrocarbons occur in areas near unweathered spills of crude oil offshore or spilled refined oil nearshore.

Anadromous fish such as shad, striped bass, or menhaden may be particularly vulnerable to a spill occurring in a critical or shallow estuarine waterway during migration periods. Shrimp and sessile shellfish are also particularly subject to injury by nearshore spills. A local estuarine breeding population of an important species could be lost due to contamination of spawning or nursery grounds. Less obvious effects may also ensue, among them, loss of planktonic or benthic food supplies. The degree of impact, of course, depends on the time of year of the spill, type of oil, duration of spawning and breeding, the type of organisms affected, the areal extent of the spill, and weather conditions at the time (1,p.107-108).

Shellfish communities may be affected directly by the laying of pipe

through existing beds, dredging of beds for new ship channels, smothering of beds by dredging and resuspension of sediments by ship traffic, and loss of area from offshore structures. Indirect effects may also occur. Habitat will be lost due to: dredging, increased sedimentation from onshore construction, and development of marsh areas. Physiological functions of fish and shellfish may be altered in areas of decreased water quality. Population numbers of aquatic organisms may decline from increased human populations settling in the coastal zone.

The South Atlantic region has sizable industries based on fishery resources, particularly in North Carolina (for oysters), but including all states (for shellfish and shrimp). In North Carolina, for instance, oyster grounds are found in the shallow waters adjacent to mainland and Outer Banks from Croatan Sound south to Bogue Sound. Hard clams and bay scallops are abundant in Core and Bogue Sounds. Reduction in the availability of shellfish populations due to oil and gas developments would affect a socioeconomic sector less capable, or willing, to find other types of employment. While the dollar value of seafood catch has increased in recent years, the pounds of catch have declined significantly (26,p.63). Causes of the decreased nearshore fish harvests may be attributed to: overfishing, sewage pollution, runoff from farming operations.

The degrees of adverse effects of oil and gas activities on fish and shellfish resources will depend also on the size of the reserves which are found. A high find for the Baltimore Canyon area of 1.4 billion barrels of oil or of 1.3 billion barrels for the South Atlantic would produce more severe effects than a low find occurrence. Also, enforcement of environmental protection laws by federal and state agencies and adherence to zoning/planning requirements set forth by

coastal states should reduce the likelihood for adverse effects.

5.5 BIRDS AND WILDLIFE

Approximately 380 species of birds are listed by BLM (1,p.359b) as occurring in the Mid Atlantic area. A large majority of these birds occur on a migratory basis, with large waterfowl concentrations being prevalent in spring, winter, and fall in most coastal marsh areas. The estuarine marshes of Delaware, Maryland, and Virginia afford the largest areas of coastal habitat for birds, with the Chesapeake Bay playing the major role.

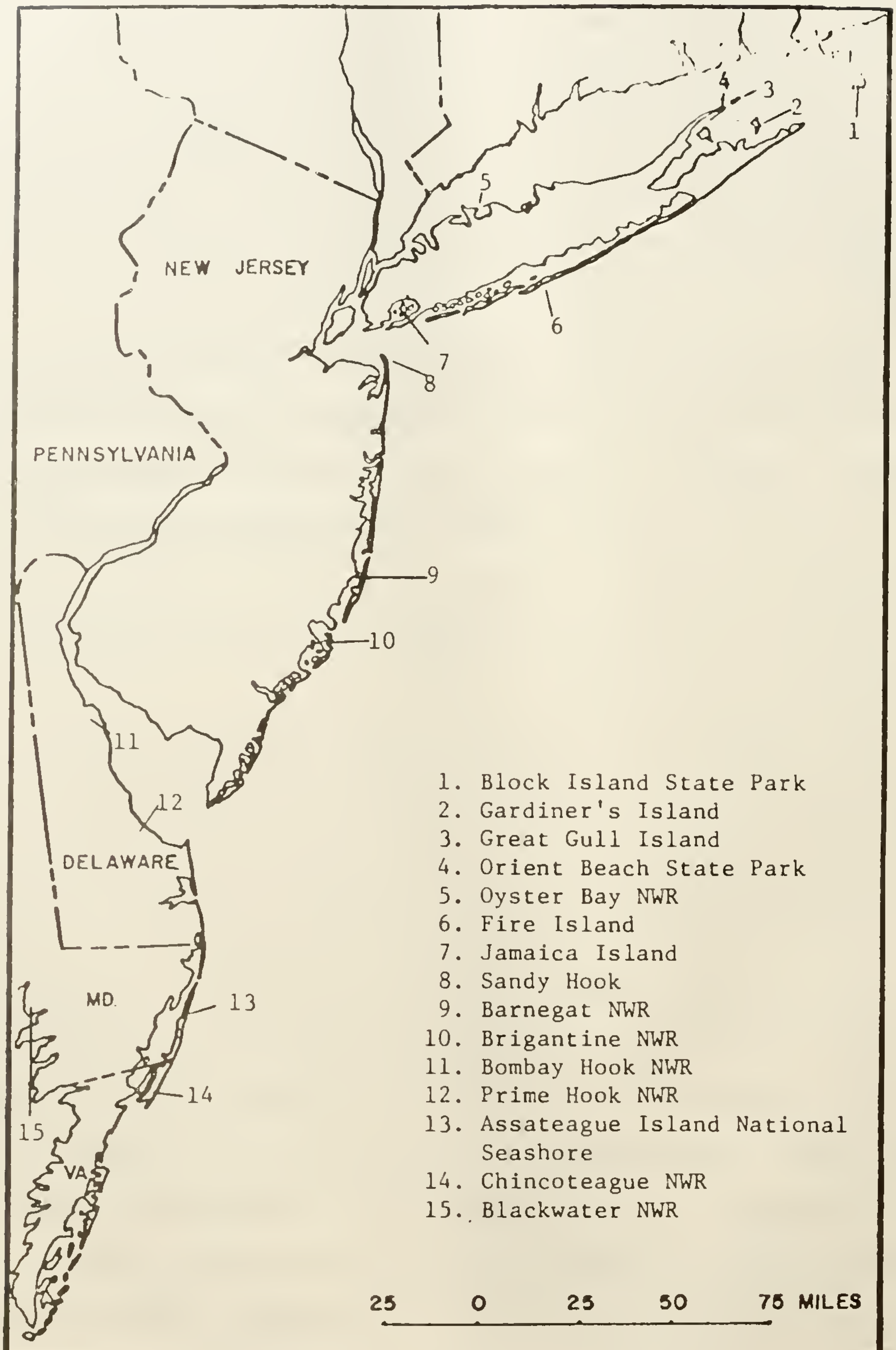
In the Southern Atlantic region, the vast sounds of North Carolina, protected by the Outer Banks, afford vast acreages of habitat for waterfowl populations. The number of species listed as occurring further south, such as Florida, are over 400, but the size of waterfowl populations are much smaller in the southern portion of the study area.

Figure 12 illustrates many important breeding and refuge areas in the Mid Atlantic area (1,p.363).

Birds, and wildlife populations, in the Mid Atlantic or South Atlantic coastal regions could be affected by OCS-related activities in the forms of oil spills, loss of food resources, loss of habitat, general disturbance, increased hunting pressures, and chronic hydrocarbon intake from oil discharges.

Oil spills are a considerable potential threat to bird populations. When the inner feathers of birds are coated with petroleum, the insulating properties of the feathers are lost, and a bird can literally freeze to death in any season. Birds may also lose their ability to fly or may drown. Diving birds may acquire oil by entering oil-slicked water directly, while shore birds may pick up oil by moving about in a habitat covered with wash-up oil. Birds are also attracted to oil-slicked waters due to the calm surfaces.

Figure 12. Selected major refuge and breeding areas (Source: Reference 1).



and thus may enter oil spills by accident. Some species of sea birds are more prone to oiling than others. Diving birds have suffered the greatest casualties in large oil spills whereas others, such as gulls and shearwaters, suffer fewer casualties (1,Vol.2,p.325). As further stated by BLM (1,Vol.2,p.327):

> The migratory waterfowl are probably among the most susceptible due to their flocking habits and the large number of birds using the Atlantic Flyway. Flocks of migratory waterfowl could be impacted during the spring and fall migrations. If oil should impact these areas, populations can be reduced through loss of habitat or direct fouling. Marshland habitats would be most susceptible to spills from nearby pipelines or tanker accidents along their routes. Marsh communities of coastal New Jersey and to a lesser extent those of coastal Delaware, Maryland, and Virginia might be especially vulnerable to spills from pipelines. Communities adjacent to tanker routes into New York harbor and Delaware Bay could be especially vulnerable to spills resulting from tanker accidents.

Contamination of estuarine areas with oil may lead to impacts on bird populations if food supplies are reduced or affected. The long term damage to bird habitats from chronic low level oil pollution may exceed that caused by irregular catastrophic spills.

Onshore activities associated with OCS development may also affect bird and other wildlife populations. Activities associated with pipeline burials and construction of facilities can impact bird populations from increased human disturbance and through loss of habitat. Disturbances associated with the construction stages are believed to be relatively short termed and the extent of damage can vary. Loss of habitat due to placement of facilities is expected to be permanent, with changes in local populations occurring as a result. If facilities should create changes in air and water quality, noise levels, and so on, they can affect surrouding populations (1,Vol.2,p.329).

Terrestrial wildlife populations are subject to the same impacts as other segments of the coastal ecosystem, i.e., oil spills in the marsh zone,

direct effects of pipeline and facilities construction, indirect changes from food source alteration, and secondary impacts from reduced available habitat and increased sport hunting.

BLM (1, Vol.2,p.331) presents the following possible impacts for terrestrial fauna:

> Direct impacts resulting from construction as a result of the proposed sale would be the greatest on the small mammals, reptiles, and amphibians of the area (distributions appear in Section II.F.2.c) at construction sites. The extent of the impacts would ultimately depend on habitat recovery but should be limited in magnitude and of short duration. Only those individual animals having home ranges within or overlapping the actual zone of construction could be either destroyed or displaced. The impact would depend on the place, the habitat, and the season of the year.

6.0 SOCIO ECONOMIC IMPACTS - PAST AND FUTURE

6.1 DEVELOPMENT EFFECTS

In general, it can be assumed that future impacts of OCS oil and gas activity will be greater on the environment, on other industries, and on communities in areas where no previous OCS oil and gas leasing has taken place, when compared with areas where such activity has already been initiated. This follows since new pipelines and storage facilities must be built, working relationships must be developed between previously existing industries, (i.e., fishing) and the new oil and gas industry, and new labor forces with associated payrolls will be introduced to areas with less economic activity. Thus, the socio economic impacts, both positive and negative, will likely be greater on the Mid Atlantic - South Atlantic coast than for similar lease sales for offshore Louisiana or California where offshore and nearby onshore production has been in existence for many years (26, Vol. 4, p. 1).

The possible favorable socio economic impacts of OCS development are very dependent on the environmental impacts of such activity. Many of the direct benefits of OCS development can be readily nullified if valuable recreation and commercial/sport fishing industries are damaged by an increased number of oil spills, loss of wetlands, and greater sources of air, water, noise and visual pollution.

By carefully planning and selecting of locations for support activities

it should be possible to reduce the risk of adverse impact in areas that are of particular value for another use. In the South Atlantic region where the coastal area remains mainly underdeveloped, there are numerous environmental management areas interspersed with centers of tourism and port activity. Ports and their associated activities concentrating the largest populations and heaviest industries around them, place the greatest demands on the coastal environment. They are logical sites for locating future OCS support activities for the region.

In spite of the potential threats to sensitive environmental management, recreation, and tourism, the development of support and service industries onshore is viewed as desirable by some, as well as undesirable by others, as indicated by public meetings held by CEQ (21,p.121):

> "Many, including representatives of the petroleum industry, regional utilities, local businesses, chambers of commerce, and governmental officials, testified that economic gains to particular regions and the growth of new industries not only are beneficial but are urgently needed. They cited high unemployment rates, the need for petroleum, and a desire for economic diversification as reason for developing the outer continental shelf.
>
> Others said that their communities could not accommodate the volume and pace of development likely - not just the construction of refineries and other processing facilities but the residential and commercial development needed to support the influx of population and economic activities. Their concerns were not limited to wetlands, beaches, and other natural areas; they also feared the loss of traditional values, established lifestyles, and the character of their communities. Often cited were the lack of planning and land use regulatory mechanisms to cope with the development pressures. And some saw irreconcilable conflicts between industrial development and recreation, tourism, and commercial fishing."

Just what effects caused by oil and gas development can coastal regions in the Mid-Atlantic and South Atlantic anticipate? Since the exact extent of recoverable oil and gas is unknown, communities must look ahead to economic, social, and environmental impacts that may never come (if no oil is found) or to sudden surges of development (if a large oil or gas field is discovered) (5).

In spite of the lack of specific information upon which to judge future development effects, it has been possible to make some preliminary assessments predicated on assumed production rates and facility locations (i.e. pipeline routes, operations bases, gas processing facilities, etc.) at the county level of detail. With respect to the Mid Atlantic, studies indicate that impacts on the region as a whole should be minor but major impacts could be felt by several primary impact counties. Regional population increases have been estimated to be as few as 20,000 and as high as 60,000 for peak production rates (.75 to 1.0 million barrels/day).

At the county level, the estimates have attributed as much as 20% of the growth in population to OCS activity, in those counties that are the site for new facility locations, (Atlantic County, N.J., for example).

Development variations will depend on the size of the offshore lease area, location in relation to offshore leases, extent of existing facilities, proximity of markets, and rate and type of development. As stated earlier, Mid Atlantic oil may replace some or all foreign crude oil imports and will be refined, and generally used, in the Mid Atlantic region. The same is likely to be true for the South Atlantic. The availability of pipeline networks, ports, industrial centers, and a large labor pool within a very large population, will tend to mitigate somewhat against massive socio economic

changes in any one county or state of the Mid Atlantic (13). Some developments, such as Brown and Root's proposed platform construction yard in Northampton County, Virginia, at the tip of the Delmarva Peninsula, will produce significant local changes (30). The Brown and Root proposal would remove up to 2,000 acres from active farming or wildlife habitat area, would impact on nearshore Chesapeake Bay waters, and would employ almost 1,500 persons (about 29% of the 1975 population level of the county) (30).

Secondary impacts would also be highly significant, although Planners, Inc. estimated that the incremental effect of offshore drilling in the South Atlantic is unlikely to increase population growth in the region by more than 100,000 additional persons by the year 2000 given the assumption of crude oil imports and refinery/petrochemical self-sufficiency. This would substantially affect schools, roads, police and fire protection, transportation, housing, shopping, and in general, induce a change in the quality of life and type of life style previously followed in this rural area.

In a more general manner, the development period is commonly the time when decisions with long-range consequences are made. Drilling platforms must be constructed, oil refineries and gas processing plants built, pipelines laid, storage tank "farms" developed, tanker ports readied, and petrochemical and other oil-related businesses started up. Construction employment peaks during the development period.

However, the above direct effects of oil-related activities are only one of the major problem areas. It is clear that the secondary impacts of development may have a far greater impact on local communities and counties. Since there has been no development to date on the Mid Atlantic and South

Atlantic coastline in support of OCS oil and gas activities, it is worthwhile to examine socio-economic impacts which occurred in Scotland during the development of the North Sea oil fields.

As the oil industry moved into picturesque towns such as Aberdeen, Dundee, Inverness and Edinburgh, so did a wide spectrum of support companies and service organizations (29). Housing for the influx of new workers was a major problem, one made worse by a severe inflation in land prices. Housing construction lagged because local construction workers went to work for the new oil-related industries. Jobs in many other needed services also went unfilled because of the housing shortage. Contrary to general expectations, not all local residents benefited from the job boom, because many of the jobs had to be filled by employees imported for their specialized skills.

Local price inflation made it harder for residents who did not join the oil rush to make ends meet. Public schools became overcrowded. Scarce arable land was lost to industry and housing. More air and water pollution accompanied the increase in population and industry (29, p. 28).

The conclusions of the study Onshore Planning for Offshore Oil (29) are that the rapid growth impacts can be more easily absorbed in urban areas with a diversity of business and industry. But some of the onshore locations required for oil activities, such as new platform construction yards, are more rural in character because of the large land requirement. Despite the impacts some of the cities and fishing towns have faced, even greater changes must be anticipated in such rural areas as the Shetland Islands, or in our case, Northampton County, Virginia. A local economy will be affected not only by the investment and employment of the oil industry itself but also by the many private businesses needed to support the new industry and spiraling

population. Each stage of oil development requires some more housing, offices, stores, banks, hotels, restaurants, basic public services (such as roads, airports, schools, utilities, police) and all the other facilities that the employees and their families will need. Many communities are hard put to expand such services and facilities, especially since local tax revenues always lag behind the heavy public investments that accompany development. Also, OCS taxes go to the Federal government, not to state or local units and thus come down through loans and other activities that are a reflection of national rather than regional priorities.

As noted earlier, the job market for local residents does not necessarily grow apace with development, because of the specialized labor needed for oil technology. It may even deteriorate, if the traditional economy of the area is adversely affected by oil growth -- farm land may be taken out of production; commercial fishing may be impaired; beach recreation and resort business may diminish; or labor, lured to higher oil wages, may be priced out of reach of traditional enterprises.

6.2 PUBLIC INTEREST AND COMMUNITY ANTICIPATION

As stated earlier in this section, the interests of local residents in the Mid Atlantic and South Atlantic regions clearly state the two key policy stands, that is, one for development of offshore oil and all the economic benefits which will accompany such activity and the other, that of going slowly--developing oil and gas after all the socio economic impacts have been clarified and the environmental planning issues resolved (33).

For the South Atlantic region, the proponents of offshore oil development have in their favor the basic economic facts: the area lies far behind the United States in per capita income, job opportunities are few, the area

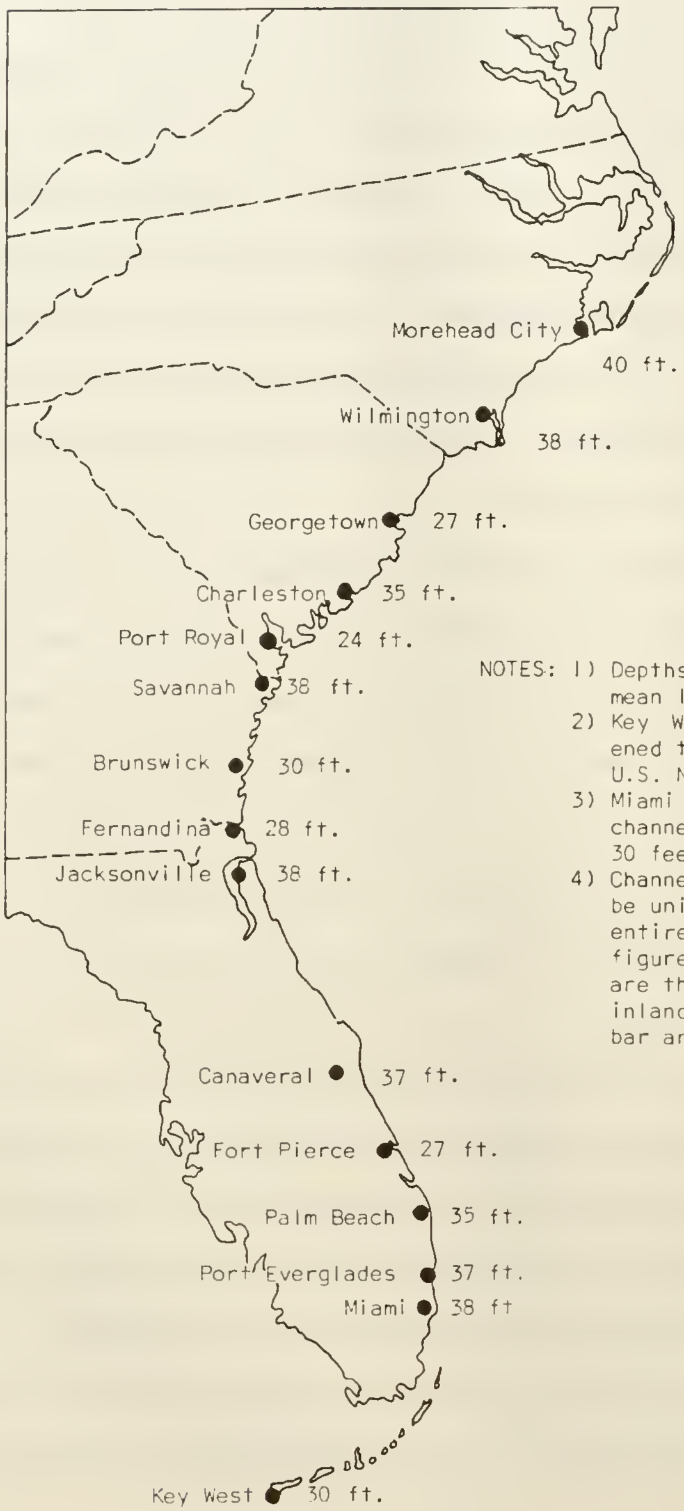
produces basically none of its own oil or gas, and impacts to the still fledgling tourism industry will most likely not be significant. On the other hand, all indications are that local impacts on the social system will be significant, especially during the first three or four years of any major activity. New employment in primary industries may be offset by losses of jobs in the resort, tourism, and fishing businesses (21, p. 121). An increased population would be the primary means of impact on the regional social infrastructure. New residents will require more water, sewers, electrical energy, schools, hospitals, and fire and police protection. Further secondary industrial growth based on the oil economy would place additional direct demands on the infrastructure.

However, in such centers as Charleston and Jacksonville in the South Atlantic and Newport News, Wilmington-Philadelphia, or Ocean County, New Jersey, in the Mid Atlantic, where growth has already occurred, new growth spurred by OCS development may place only marginal demands upon the existing infrastructure. When such demands are placed on small rural areas, these impacts may prove to be not only unacceptable, but infeasible for the local infrastructure to handle. Existing South Atlantic ports are shown in Figure 13.

The further impacts of OCS development on land use and conservation areas depend largely upon the degree to which undeveloped land is consumed, upon local attitudes toward conservation (i.e. preservation vs. conservation) in general, and upon the degree to which there are laws and formal systems which protect the lands in the state, county and municipality involved.

Public wishes, as expressed by elected representatives, do vary from state to state and county to county. Thus, in New Jersey, such counties as

Figure 13. South Atlantic ports authorized project depths - major ship channel (Source: Reference 17).



NOTES:
1) Depths referenced to mean low water.
2) Key West harbor deepened to 34 feet by the U.S. Navy.
3) Miami harbor existing channel maintained at 30 feet.
4) Channel depths may not be uniform throughout entire channel. The figures listed here are the major ship channel inland from the outer bar areas.

Ocean and Camden would welcome the economic changes brought on by onshore OCS activity in their counties, whereas Cape May County feels that possible losses to the tourism industry would be greater than benefits from the oil industry (35). Delaware as a state has a coastal zone law which, while not yet tested in the courts, prevents heavy industrial development of coastal lands. However, smaller facilities such as support bases and marinas could still be placed in limited-use industrial zones, such as that which exists in Lewes. Virginia has few broad-scale laws covering the coastal zone and in general, seems to favor the development of offshore oil and gas. The Newport News-Hampton Roads-Virginia Beach complex lends itself well to large scale support of OCS activities even though it is located somewhat to the south of the present lease areas.

North Carolina has the unique position of being too far to the south of recent Baltimore Canyon lease areas to provide any significant support. Also, the major ports, such as Wilmington, are along the southern coast of the state and may well provide services if the Cape Fear Arch area between North and South Carolina is leased and explored (32).

For the South Atlantic, less public sentiment over the likely socio economic effects of offshore oil and gas activity has been voiced due to the future date of the Southeast Georgia Embayment lease sale (late 1977). Recent meetings of the Charleston Trident Chamber of Commerce Task Force on Offshore Drilling held at the Citadel, Charleston, South Carolina, have again voiced the concern of local people about the massive changes in life styles and environment that might occur with a large offshore find. Also, though, the need for energy and jobs, and the possibility of such centers as Charleston, Jacksonville or Savannah absorbing the

growth without undue stress was emphasized. In the South Atlantic region, the general feeling seems to be one of accepting OCS activity as long as the states have a final say-so on planning for the inevitable socio-economic and environmental changes which will take place (33).

Two recent developments have taken place which may affect OCS impacts on economic and social systems. One took place in the late summer of 1976; President Ford signied a $1.6 billion bill which set up a system of "energy impact" aid to help coastal states cope with changes accompanying speeded-up oil and gas development offshore. The bill provides for loans and grants over eight years to help planning, programs and construction related to off-shore energy activities.

If, for example, a coastal community's school population were increased because of workers who moved there as a result of intensified oil drilling in offshore waters, the community could get a loan or grant to build a new school.

The law contains three main sections: $800 million for an "energy impact fund," $400 million for Outer Continental Shelf formula grants and $464 million for related planning and research. The impact money includes loan, grant and bond guarantees to provide the public facilities needed to meet energy activities offshore.

The formula grants will pay for loss to recreation or the ecology from drilling and production, or for some related services. The other money goes for settling coastal zone standards, guaranteeing public access to public beaches, extending state planning assistance and conducting new research or studies.

Through this plan many of the obvious socio economic impacts may be

ameliorated. The second development was the recent presidential election which resulted in Mr. Carter entering that office. Since there is evidence that Mr. Carter's stand on energy has been one of more rapid development of the United States coal reserves and on energy conservation rather than on an all-out OCS leasing program in every conceivable region of the United States, the nation may well take a more leisurely approach to offshore leasing, thus possibly affecting the timing of the South Atlantic, and other lease sales.

7.0 REFERENCES

7.1 REFERENCES CITED

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7.2 ANNOTATED LIST OF KEY PUBLICATIONS

GENERAL

1. OCS Oil and Gas - An Environmental Assessment. A Report to the President by the Council on Environmental Quality. April, 1974. 5 Volumes.

   These five volumes present a comprehensive review of the outer continental shelf oil leasing program, including onshore and offshore effects, economic considerations, socio economic changes, relevant OCS oil and gas technology, offshore oil spills, oil spill trajectories, and the ecology of the various regions involved. Primary interest was centered on the Atlantic Coast and Gulf of Alaska frontier areas.

2. Primary, Physical Impacts of Offshore Petroleum Developments. Massachusetts Institute of Technology. April, 1974. Prepared for the National Oceanic and Atmospheric Administration.

   An analysis of past oil spill statistics, projections of possible OCS spills and leaks, and an analysis of likely oil spill trajectories is presented herein. Three areas are specifically analyzed: Delaware Bay, Charleston, S.C. Harbor, and Narragansett Bay.

3. Petroleum in the Marine Environment. Workshop on Inputs, Fates, and the Effects of Petroleum in the Marine Environment. National Academy of Sciences, Washington, D.C.,1975.

The report presents an extremely concise, scientific assessment of the effects of oil in the marine environment.

MID-ATLANTIC

1. Final Environmental Statement - Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale Offshore the Mid Atlantic States - OCS Sale No. 40. Bureau of Land Management, United States Department of the Interior, 4 Volumes, May 25, 1976.

   This EIS covers all aspects of the proposed Mid Atlantic Lease Sale No. 40 and predicts possible environmental, social, and economic impacts. Extensive descriptions of the proposed project and of the baseline condition of the environment provide significant data for an understanding of the region's offshore and nearshore characteristics.

2. Coastal and Offshore Environmental Inventory: Cape Hatteras to Nantucket Shoals. University of Rhode Island, Marine Pub. Ser. No. 2 and 3, Kingston, Rhode Island, 2 Vols.

   The two volumes of this series cover existing coastal and offshore environmental information in great detail, specifically: oceanography, phytoplankton, zooplankton, benthic fauna, fisheries, marine mammals, birds, coastal vegetation, marine geology, offshore weather and climate, and coastal zone utilization.

3. A Study of the Socio Economic Factors Relating to the Outer Continental Shelf of the Mid Atlantic Coast. 9 Volumes. Mary Jenny and Joel Goodman (eds.) College of Marine Studies, University of Delaware for the Bureau of Land Management.

This series is valuable in its treatment of the socio economic baseline conditions of the Mid Atlantic area and the likely changes which might arise from OCS activities. Of major interest are the volumes on land and water use, recreation, demography, and OCS target areas.

4. Mid Atlantic Regional Study - An Assessment of the Onshore Effects of Offshore Oil and Gas Development. Prepared by Woodward-Clyde Consultants for the American Petroleum Institute, October, 1975.

A good synopsis of the overall onshore effects of the predicted OCS activities. The report's value lies in its general treatment of the entire spectrum of activities and projected effects on the social, economic, and environmental systems. Numerous maps aid in an understanding of the presented data.

SOUTH ATLANTIC

1. A Socio Economic Environmental Baseline Summary for the South Atlantic Region Between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Prepared by Planners, Inc., for the Bureau of Land Management, U.S. Department of the Interior, September, 1974. 5 Volumes.

These five volumes cover the topics of: socio economic inventory, geological oceanography, chemical and biological oceanography, climatology, and physical oceanography, and are valuable source documents for an understanding of the environmental baseline condition.

2. South Atlantic Outer Continental Shelf Oil and Gas Exploration, Development, and Production. Prepared for the Task Force on Offshore Drilling of the Charleston Trident Chamber of Commerce by the

Citadel, Charleston, South Carolina, June, 1976.

This summary of a series of studies presents a concise view of the expected OCS activities of the South Atlantic area. The entire scope of activities, from national energy needs to local economic and environmental requirements are presented in short synopses; this presents a useful picture of regional goals and attitudes.

3. Florida Coastal Policy Study: The Impact of Offshore Oil Development. Florida Energy Office and State University System of Florida, December, 1975.

A comprehensive study of past and future offshore oil and gas activities in Florida and the expected socio economic and environmental effects and planning requirements necessary to properly meet such effects.

4. Activities in Georgia's Coastal Waters: Past Trends and Future Prospects. Office of Planning and Research, Georgia Department of Natural Resources, May, 1975.

Georgia's coastal environment is described and analyzed in regard to past activities and likely future uses, including impacts of offshore oil and gas leasing.

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